DOCUMENT RESUME

ED 295 841 SE 049 224

TITLE Women and Physics. A Day in the Life Exclusive!
INSTITUTION Institute of Physics, London (England).
PUB DATE Oct 87
NOTE 31p.; Photographs may not reproduce well.
AVAILABLE FROM Institute of Physics, 47 Belgrave Square, London SW1X 8QX, England.
PUB TYPE Guides - Classroom Use - Materials (For Learner) (051)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS *Career Awareness; Career Choice; Career Education; Career Exploration; Career Guidance; *Females; Foreign Countries; *Occupations; *Physics; Science Education; Secondary Education; *Secondary School Science; *Vocational Education

ABSTRACT

Many feel that more female role models are needed in the physical sciences to encourage young women to consider careers in chemistry and physics. This publication contains 28 profiles of women with careers in physics. Each one is written to show how each woman would spend a workday and some of the activities in which she might participate. Careers represented include: astronomer; broadcaster and writer; diagnostic radiographer; environmental physicist; geophysicist; government scientist; information scientist; laser technologist; medical physicist; medical physics technician; meteorologist; optics consultant; patent agent; physics lecturer; physics teacher; product marketing engineer; flight systems technician; real-time computing scientist; research and development physicist; research director; sales/marketing manager; sales office assistant; satellite design engineer; school physics technician; scientific journalist; semiconductor technologist; senior civil servant; and television broadcast engineer. (CW)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED295841

A Day in the Life

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☐ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

B Madge

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

EXCLUSIVE! WOMEN AND PHYSICS

SE 049 234

1 An Astronomer
2 A Broadcaster and Writer
3 A Diagnostic Radiographer
4 An Environmental Physicist
5 A Geophysicist
6 A Government Scientist
7 An Information Scientist
8 A Laser Technologist
9 A Medical Physicist
10 A Medical Physics Technician
11 A Meteorologist
12 An Optics Consultant
13 A Patent Agent
14 A Physics Lecturer in a University
15 A Physics Teacher
16 A Product Marketing Engineer
17 An RAF Flight Systems Technician
18 A Real-time Computing Scientist
19 A Research & Development Physicist
20 A Research Director
21 A Sales/Marketing Manager
22 A Sales Office Assistant
23 A Satellite Design Engineer
24 A School Physics Technician
25 A Scientific Journalist
26 A Semiconductor Technologist
27 A Senior Civil Servant
28 A Television Broadcast Engineer

Produced by

The Institute of Physics
47 Belgrave Square
London SW1X 8QX

Reprinted Oct 1987

A Day in the Life of...

AN ASTRONOMER

Woken up at 03.15 by the telescope alarm. Dress quickly in warm clothes and boots and scramble up the hill to the telescope. An error message indicates there is no voltage supply to one of the photomultipliers (a detector measuring the light from a star). Swap to the spare voltage supply and restart the telescope on its observing programme. Back to bed at 04.00.

The sun rises at 07.00 and I am woken by the dome's roof closing automatically. On my way down to the recreation area for breakfast, I check that the telescope completed the night's observations. This is a good opportunity to discuss them with the astronomers working on the other telescopes on the mountain top. They are on their way to bed now — I am lucky to be working with an automatic telescope! They've had some trouble finding faint objects to the south. There may have been cloud about or perhaps it's another belt of dust from the Sahara. I'll need to keep this in mind when I reduce the data later.

Back in the dome it's time to analyse the observations. They are stored in the computer together with various monitoring measurements such as the weather data. The results from the night are displayed as a graph on the computer terminal and I decide which corrections I must apply to take into account the movements of the telescope. There are a lot of stars "not detected" in the south — obviously a patch of cloud there. Although we are at 8,000 ft we still get occasional patches of thin cloud above us. I discard the observations from the cloudy area and save the corrected observations onto magnetic tape.

Interrupted by a telephone call from England. A colleague would like one of his computer programs modified. Note his instructions — I'll do it when I've completed the reductions.

Chris Thoburn with the Carlsberg Automatic Meridian Circle telescope in the Roque de los Muchachos Observatory on Ld Palma in the Canary Islands. Chris followed her honours degree in physics with four years post-graduate work in cosmic rays, at a university.

Merge the new results into the cumulative catalogue of observations. This is a slow job. 800 new results from last night to add to the 35,000 observations made so far this year. Examine 12 problematic stars thrown out by the programs which haven't recognised them at this stage. A search through other catalogues in the library shows them to be a double star system. Will have to delete these stars from the input list.

Take a quick look at the voltage supply that failed last night. Fortunately we have a circuit diagram for it, so I can monitor the voltage at various points in the circuit and check it against the correct value. Discover a nice black capacitor! Naturally we have no replacement in the dome. This seems a good time for lunch.

Over coffee I corner one of the site engineers — has *he* got the capacitor I need? Yes, he has. We have a small workshop in the dome, so it's an easy job for me to remove the old capacitor and solder in the new one. Switch on the supply unit and check it now works. Return the unit to the spares shelf.

Modify one of the programs as per instructions from England. Check that the change does not affect the observing process by observing some calibration objects.

Now have a shower and catch up on some reading in the sunshine before dinner at 18.00. 19.00 the sun is about to set and it's time to start up the telescope for the night. Stay to check that the first few observations look good. Complete the daily logbook. Just got time for a game of table tennis before bed — if I can find an opponent!

A Day in the Life of...

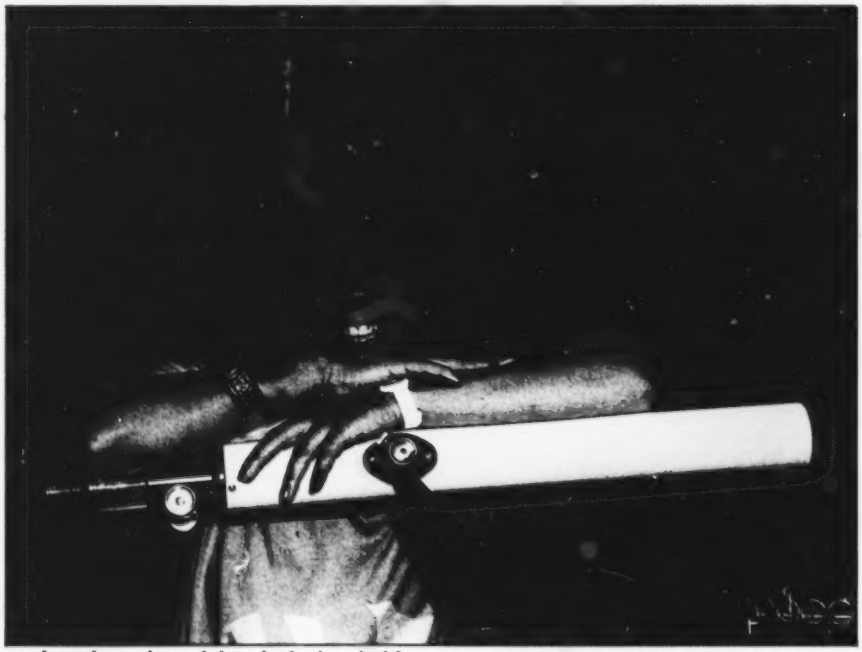
A Broadcaster and Writer

Wellington, New Zealand: May 25 1987

Monday morning – and it's nice to wake refreshed after a 7 hour sleep. I've been averaging 2 hours a night over the conference this weekend (there really are too many people to see and talk to!) and I've still got 8 more towns to fit in on this lecture tour in as many days! Graham Blow comes to pick me up. He's worried about me being tired, but I'm more worried about *him:* not only has he organised my lecture tour *and* the NZ Royal Astronomical Society Conference just gone, but he has just got the news that the Carter Observatory where he works – the National Observatory of NZ – is under threat of closure. The government has adopted a "user pays" policy towards science – but it doesn't realise that such a policy can never work for a *pure* science like astronomy. At least I can help a little by drawing attention to the observatory's plight as I travel around. This is something quite unexpected: when I was invited, Graham told me that my brief was to "get the public excited about astronomy again after the failure of Halley's Comet"!

At the airport I give Graham a big "good luck" hug – I'll see him next weekend when I return to Wellington to give the Victoria University Memorial Lecture – then I board a little Fokker Friendship for Nelson, a short hop across the Cook Strait. As we fly in over the South Island there are incredible views of mountains and little dissected bays just begging to be explored. Nelson itself is a treat. I'm met by Syd Robinson, secretary of the local astronomical society and it's straight to the Nelson Observatory for an interview with the local paper. Like all NZ towns, Nelson has a small public observatory run by the local amateur astronomers – Britain, take note! Tracey interviews me while Mark takes pictures; I make the point that if the National Observatory closes, then facilities like this will have no support. But it's all great fun – Tracey says she hasn't enjoyed herself so much for weeks! Say goodbye to the nice 5in Cooke telescope and Syd drives me to the radio station for another interview. This one's a phone-in and there's the inevitable flying-saucer nut who calls!

Now a couple of hours to relax before the lecture tonight.



Heather Couper, broadcaster and writer on astronomy and space subjects, taking a breather. A joint degree in astronomy and physics started Heather on her career.

Time for a whistlestop tour of some of Nelson's historic colonial buildings before meeting Peter Robinson, the President of the local astronomical society. Briefly to my *very* up-market guest house, in order to change; then to the Cawthorn Institute for my talk on 'Exploding Galaxies'. People just keep coming and coming and coming! They tell me it's because I was on TV a couple of days ago and they all want to meet me. Eventually, there are over 100 people crammed into a lecture room designed for 30. Fortunately, they are all wonderfully good-humoured and relaxed. Now it's time for me to sing for my supper. My main aim in lecturing, writing or broadcasting is to entertain: I want people to go away feeling: "Well, science can be fun – and relevant. And if *she* can understand it, then so can I". Despite the heat, the crowd and the daunting age range (4 to 85), everyone seems to go away happy: you can usually tell from the questions you get asked afterwards! Chat over a cup of coffee to the people who've come along, then it's back to the guest house for a party. It's all great fun, and the loveliest moment comes when Albert Jones – the delightful veteran variable-star observer, who discovered '1987 A', the recent supernova – asks me to countersign his application form to the Royal Astronomical Society.

At 1.00 a.m. I extricate myself from a group of local vineyard owners to 'phone home. It's 2.00 p.m. in London, and Nigel Henbest – Astronomy Consultant to *New Scientist* – is just finishing lunch. Yes, all is on course for the "recce" for my next TV series, *The Stars*. Nigel, as research consultant to the series, will join me in New Zealand prior to flying to Australia and Hawaii, where we will be checking out locations and potential interviewees. But first we deserve a holiday!

The party goes on till 3, when I stagger into bed. I really must sleep: there's an 8.30 a.m. radio interview before I fly tomorrow morning, followed by Christchurch, Dunedin, Invercargill, Wellington, Gisbourne, Auckland and Whangerei . . .

A Day in the Life of...

A Diagnostic Radiographer

My day starts at 8.45 a.m. when I greet a party of sixth-formers thinking about a career in the NHS. What should I tell them about radiography? As with so many professions within the medical world, the average person in the street knows so little about it. A radiographer is basically a member of a team of people producing x-ray pictures of patients by a variety of techniques. Although x-rays are used to produce most of these pictures, or "images", increasing use is being made of ultrasound, radioisotopes, and computer assistance. A radiographer's basic knowledge of physics is invaluable in helping to understand these rapidly advancing technologies. Detailed knowledge of radiation physics is essential to the radiographer, who must protect patients and staff from the harmful effects of ionising radiation.

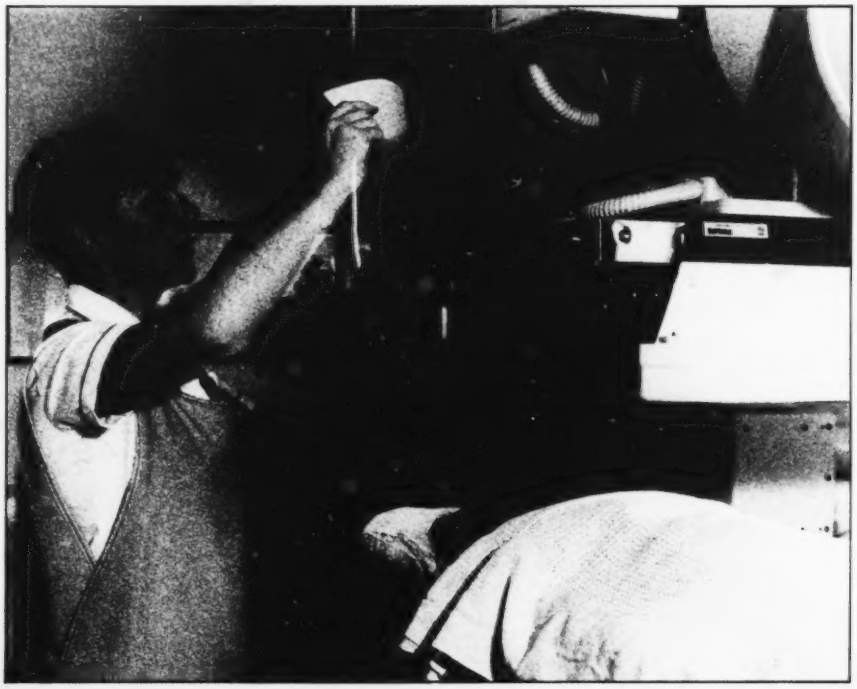
I think the sixth-formers now have a clearer idea of a radiographer's role within the great scheme of things, so I pack them off with a student radiographer to tour the department before their next stop, the Physiotherapy Department.

9 o'clock and the place springs into life as patients and staff arrive at the beginning of what will be a busy and varied day. My first task is to ensure that the rooms under my supervision are staffed and that the day's work is organised. So far so good! All present and correct, so I can go into the "screening room" where barium meal x-rays are performed. In this type of x-ray the patient drinks barium, a substance which shows up under x-rays and which allows the doctor to detect abnormalities such as stomach ulcers.

At 10.00 a.m. it's time for a quick cup of coffee before moving on to the room some of the more routine work of the department, such as x-rays of the chest and kidneys is done. Already this morning, demands have been made not only on my technical ability, but also on my skills in dealing with anxious and frightened patients who may be in considerable pain. And so it continues for the rest of the morning. Our kidney x-rays raise the suspicion that a patient may have cancer of the bladder, and we decide to try to get more information about this by performing an ultrasound scan. Here use is made of the special physical properties of high-frequency sound to build up a picture of part of the body. A knowledge of the basic physics of ultrasound is of immense help to radiographers performing these examinations. Happily not all these tests are done on sick patients, and radiographers using ultrasound are frequently asked to perform the interesting task of measuring the size of babies in the mother's womb.

At noon my lunchbreak gives me the chance to have a quick game of squash before it's back to the department for the afternoon. Since I will be using some brand new x-ray equipment I will be working under the supervision of a radiographer who is already experienced in its use. We will be using a computer to store digitally the x-ray pictures we obtain. The images we produce can then be manipulated by the computer to provide the maximum amount of information. We are all hoping that new techniques like this will mean that high-quality pictures can be obtained with much less discomfort for the patient.

Well, the day seems to have wound down nicely to 5.00 p.m. when just one radiographer will remain in the department all night to cope with emergencies. Fortunately it's not me today – I feel that I've already walked many miles! Perhaps it was the squash?



Patsy Cadigan, Diagnostic Radiographer, preparing a patient for radiography. Having 8 O-levels and with physics as one of her 2 A-levels, Patsy found that entry for the Diploma of the College of Radiographers was no problem.

A Day in the Life of...

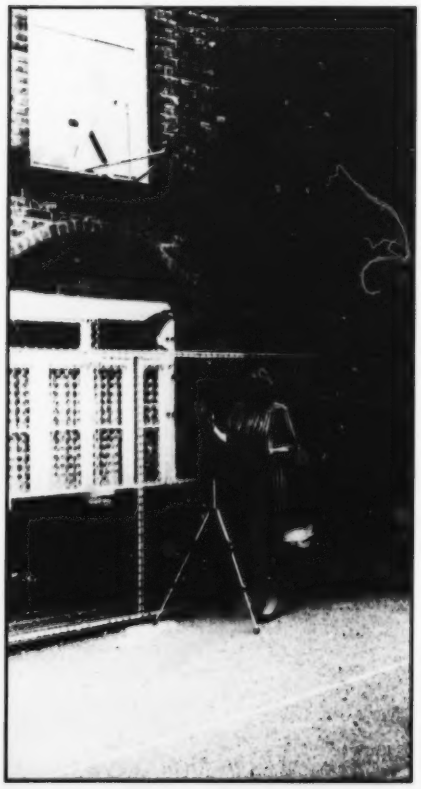
4

An Environmental Physicist

I arrive for work at 8.30 am, picking up a car from the garage on my way in as I am due to go out on site later in the morning. I park the car by the loading bay and make my way up to the office. Starting time is flexible between 8.30 and 9.30 am, but I like to get in early to settle down to work before the peace is destroyed when the 'phone begins to ring.

I sort out the file for my site visit and consult a map to plan my route. I then go along to the laboratory to make a final check on the equipment which I shall be taking out with me. I return to the office to read through some references which arrived yesterday and have a cup of tea before loading up the car and setting out for my visit.

The site visit is to investigate a complaint about noise from a boilerhouse and I intend to make some tape recordings of the noise for analysis back in the laboratory. From these I will determine if the complaint is justified and, if so, what remedial work would be necessary.



Environmental Physicist, Patricia Ellis, works for a local government body. She is seen here monitoring noise levels outside a complainant's house. Patricia followed her BSc Physics with an MSc in Pollution and Environmental Control.

On arriving at the house, I'm invited in (the occupant wondering where the MAN is), and offered a cup of tea. This provides me with an opportunity to chat to the person who's complaining about the noise to try to find out if the complaint is really due to noise or to some other feature of the house or neighbourhood which this person doesn't like. You have to be a bit of a detective in this job!

Having established that the problem is probably associated with the boilerhouse, I go in search of the caretaker of the premises so I can have a look around the plant room. He is expecting me and gives me a guided tour of the boilerhouse. I explain to him what measurements I need to take and he agrees to switch on and off the various pieces of plant in sequence. I leave him with a "walkie-talkie" so that we can communicate when I'm back at the measurement position, and then return to the house where the complaints have been made to carry out the measurements. When this is complete, I pack up the equipment, explain to the resident what will happen next, and return to the office.

On my desk when I return is a message asking me to 'phone a building contractor who has a vibration problem and requires some advice. I ring him to find that he wants to know how to keep the vibration caused in a building to an acceptable limit when some pile-driving is carried out on an adjacent building site. He doesn't know what limits would be appropriate or how to measure the vibration. We chat about the type and usage of the building which he wishes to protect and I suggest a suitable limit value for him to apply. I also agree to provide help in ensuring that the limits are met when the pile-driving actually starts.

The 'phone rings again almost immediately with someone wanting advice on the use of a new piece of instrumentation which they have just bought. I explain how it can be used and then decide to go to lunch before there are any more calls!

After lunch, I call a customer for whom I'm investigating the noise emitted from a factory. We agree a date for a site visit and I plan what measurements to take and go along to the laboratory to book the necessary equipment for the required days. Whilst there, I set up some analysis equipment to look at the frequency content of the recordings I have made on a generator some days previously. It should be possible to relate the dominant frequencies to some basic action of the generator and then advise on the way in which it can be silenced. Having found a frequency which is dominant, I return to the office to carry out calculations to determine the cause of this and what would be required to reduce the level of noise emitted to acceptable levels.

Rewarding my efforts with a cup of tea, I head for the wordprocessor to alter a report which I sent for typing a few days ago. This is about the effect of traffic noise along a busy street. I make a few corrections to the report and draw some figures to go with it, then make arrangements for it to be copied, bound and sent to the customer.

I quickly check my diary for my appointments for tomorrow, then leave for home.

A Day in the Life of...

A GEOPHYSICIST

On field work . . .

I wake up at 5.00 a.m. to a loud chorus of howler monkeys in the rain forest. The sun is already well up and it's pretty hot inside my tent. I kept it sealed tight overnight to keep out wandering ocelots and insects. Down to the fresh-water stream for a wash. A curious family of spider monkeys watches me from the safety of the tree tops. Back at camp, where the cook has the inevitable black beans and rice on, I assemble the equipment we're going to use today: the magnetometer that measures the Earth's magnetic field; the theodolite that will measure the relative height of each spot we choose as a "station", and the gravity meter. I take some base-station readings at the foot of Rincon volcano to make sure the instruments are working okay. Today we are going to check whether the steam field at the base of the volcano has changed since last week. By measuring the strength of the gravity and magnetic fields regularly at about 30 stations on and around the boiling mud-pool area, we can monitor the energy output. This varies with the seasons and depends on the activity of the volcano. The object is to see whether the field could support a geothermal power plant. If a plant is built, we will need to understand the natural fluctuations in it before we can explain any that happen after the wells have been drilled.

After breakfast, we load up the mules and long-suffering field assistants with equipment, first-aid kits, food and plenty of water. The boiling mud pools seem to be more vigorous today and the theodolite team is having problems because the high temperatures are causing errors in their readings. I'm getting very hot measuring gravity – the air temperature is 30°C and rising, and the steam coming up between cracks in the rocks makes it very humid. We stop for lunch by a cold stream. Then we head into the cooler parts of the forest. We need data from beyond the steam field to act as a control, so we can see how big the gravity and magnetic changes are. I clear the way to the next station using a machete and we all look out for snakes. Re-measure a few gravity and magnetic stations on the way back to camp to check for errors and drift in the instruments. Wade back across the stream and reach camp just before dark (around 5.30 p.m.) to the welcome smell of cooking on the log fire. Before supper, I put the instruments safely into the Land Rover, re-tune the magnetometer, solder some loose connections, put the batteries on charge and read the data books through. The data need a lot of number crunching by computer yet, but they look reasonable. Mules are set free to graze and we all sit around the fire to eat, and discuss tomorrow's objective, which is to make some measurements around the summit crater of the volcano – a six-hour walk away. The weather looks perfect so we decide to set off at 5.30 a.m. Better get to sleep now!

Back in the U.K. . . .

Get into the lab at about 9.00 a.m. and start off by going through the mail. Among the various brochures for geophysical equipment and research news is a reminder to submit my paper for the conference coming up soon in Hawaii on "How volcanoes work". Still have a bit of number crunching of gravity data before I can write that.

Check the gravity meters that have been measuring the effect of Earth tides overnight (the same force that produces ocean tides causes the Earth to expand and contract each day). There must have been an earthquake somewhere last night because the record is disturbed. Change the chart-recorder roll and set it up again.

Log on to the computer to do some data modelling for the paper. Gradually a realistic model for the plumbing system beneath Poas volcano evolves. Set the program going over lunch.

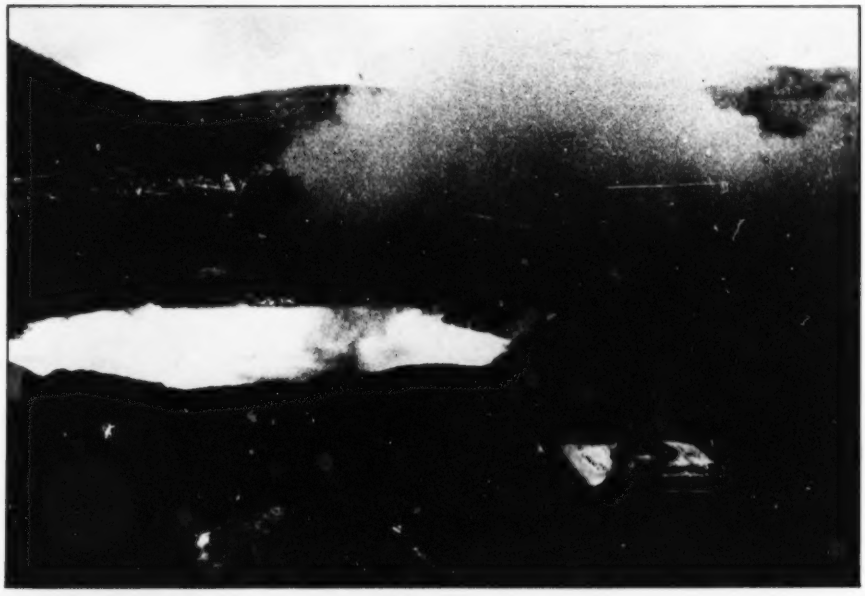
At the bar, conversation goes from the latest problems with the mass spectrometer, to tactics for next week's cricket match (mixed of course) against the technology department.

Back to the lab where the 'phone doesn't stop ringing. Field assistants wanting to know what clothes and innoculations are suitable for Iceland, Chile, Costa Rica or whichever expedition they are helping with. A colleague calls to see if I can measure gravity at Southampton dock next weekend. As the dock fills with water, gravity changes and by measuring it precisely we hope to determine, for the first time, a new term in the expression for *G*, the universal gravitational constant.

Off to the library for some peace and quiet, and to catch up on the latest research papers. Pick up the computer print-out on the way back to the lab and work through the models the program produced.

There are a lot of instruments to test and assemble before the next field expedition – Costa Rica in just 10 days' time. Check batteries, connections, calibrations . . . and write out insurance and customs papers for each item. Start trying to load three Land Rovers' worth of equipment into one – it usually works eventually.

Finally manage to sit down and start work on the paper. By the time I go home, at about 6.30 p.m. it's still not finished, but tomorrow is another day.



Dr Hazel Rymer, shown here measuring gravity at Poas volcano in Costa Rica, is a geophysical research fellow with the Open University. Having completed a BSc in physics, Hazel went straight on to do a PhD in Geophysics.

A Day in the Life of...

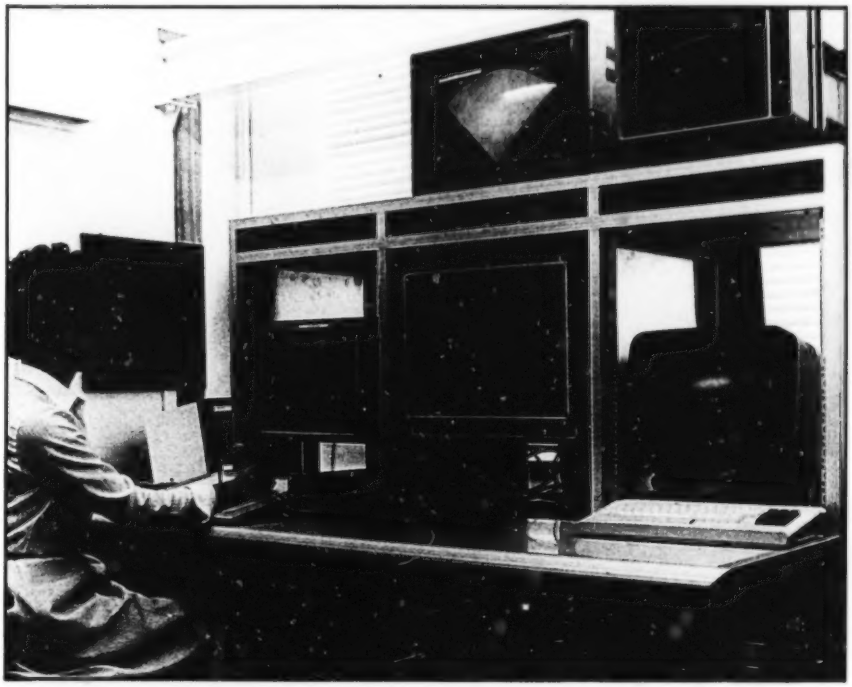
A Government Scientist

My working day begins at 8.30 am at the Admiralty Research Establishment, Portsmouth. The section to which I am attached provides specialised software in support of Royal Naval equipment which is still in the research and development stage.

I have a chat with the five team members to discuss progress on the current project and the problems which have inevitably arisen, then allocate responsibility for sorting them out. Next, it's back to the office to check my diary for the tasks to be tackled that day. Hmm . . . looks like I'm going to be busy.

Top of the list is to sort out the "in" tray. My "in" tray today includes some technical magazines circulated from our on-site library, notification of a forthcoming project meeting, a technical report for me to read and comment upon, circulars from our site administration, minutes of our recent progress meeting — which means I have actions to complete . . . Before I have managed to make much of a dent in it, my boss comes into the office with some visitors to talk about our project and to give them a demonstration of our software, including the latest graphics. Coffee time provides a convenient endpoint to the discussion and my boss and visitors depart while I head for the coffee area along with everyone else.

Back in the office again, I receive a 'phone call from the photographic section. They have a query about some slides I had requested for a forthcoming presentation of our work at a computer conference. I visit the photographic section to resolve the problem. On the way back to the office I call into the computer room, where salesmen from a commercial firm are demonstrating their latest desktop computer and accompanying graphics display unit. It's very impressive — pity it's so expensive!



Dr Dolores Byrne at work. Among her qualifications Dolores has an honours degree and a PhD in physics.

It's lunchtime and today I'm playing squash in the neighbouring naval base. My squash opponent and I are well matched, so the game is close but very enjoyable.

Immediately after lunch I attend an inter-divisional meeting to discuss our forthcoming sea trials. We wish to test our latest equipment and software at sea and this requires close liaison with naval staff and with the dockyard staff. It is important that, well in advance of going to sea, we specify our requirements for space for equipment, electrical supplies and accommodation for scientific personnel to conduct the experiments. We also wish to record our experiments both on video and on magnetic tape for subsequent analysis back in the lab.

The meeting finishes at 4.45 pm. I get back to the office to find that the computer has broken down. But the good news is that the computer engineer will be with us first thing in the morning. I jot down in my diary a few tasks which must be done tomorrow, note that the "in" tray has grown and add that task to the top of tomorrow's list!

A Day in the Life of...

7

AN INFORMATION SCIENTIST

I arrive at about 8.30 am to find Carol, the Company Librarian, well into action, and a pile of 20 magazines (just the day's supply) waiting to be scanned. I open the post to find a dozen or so letters, meetings notices, invoices, advice notes from Trade Associations, parcels of information requested, and anything else the Post Room can't think where to send!

Yvonne Codling. Having followed a thin sandwich course Yvonne gained a BTech in Applied Physics.

Marianne is at a local university this morning trying to find out about the modes of vibration of quartz for one of our engineers.

Fiona is at the computer terminal searching for new references to articles published in journals or in conference proceedings on fast analogue-to-digital converters.

Like me, Marianne and Fiona are both physics graduates. Fiona decided a couple of years ago to go into Information Science, so enrolled on an MSc course which included a year's industrial experience in the British Library. Marianne is following the same path I took a few years ago — of joining an electronics company to learn Information Science on the job and by attending short specialist courses.

Our job is fundamentally to answer technical questions from members of staff and to provide them with information to keep them up-to-date with advances in their fields. There are vast amounts of information hidden in books, conference proceedings, reports and journals, but the skill of my job is finding out where to look for a certain gem of information and doing this quickly and efficiently to save the valuable time of engineers. Fiona, Marianne and I have all been trained to do this, but are constantly learning.

The company is a fairly large British electronics company making electronic components and instruments, so our job involves the whole spectrum of physics covered by this, yet allows specialisation and deep involvement in particular problems. Questions we are asked range from summarising the methods of measurement of pressure, through identifying the properties of "Arnite", to defining the maximum frequency of sound that can be transmitted in a gas. An essential qualification is the ability to communicate with the engineers — to understand the context and the details of their question.

This morning I log on to the computer "Beep! . . . You have 2 new mail messages". The first is greetings from a colleague in the Information Service of a sister company in California, the second is a request for "anything you can find out about electroluminescent displays".

At midday I head for the staff restaurant for lunch with the engineers from Central Research. This is a good opportunity to hear what they are working on, the brilliant ideas of the morning, the date of the next party etc.

Marianne arrives delighted with her morning's work at the university. Not only did she take notes from some excellent books, but she also found a resident expert researcher to talk to and found the answers to many of her questions very quickly.

After lunch I usually tackle the daily stack of journals. I try to scan each of these for news and technical articles which might be relevant to particular staff: I don't do all their reading for them. Carol circulates many journals around the company anyway, but I try to spot the unexpected, anything needing urgent action, interesting patents, and anything I think might be missed.

Carol leaves at about 5.00 pm, followed shortly afterwards by Marianne and Fiona. I check my diary, plan tomorrow's meetings and calls, then I lock up the office and go home.

A Day in the Life of...

8

A Laser Technologist

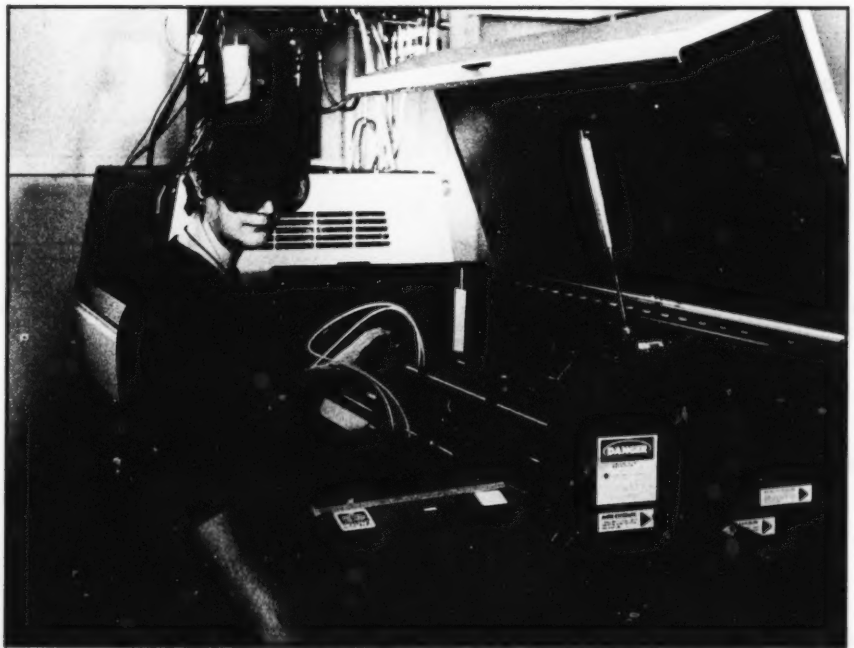
I arrive at work at 8.30 am (the bus on time for once!) and am immediately nabbed by my boss along with the rest of the team. We discuss what we will need for the experiments scheduled for the next few weeks, and decide who will be responsible for each item. The meeting breaks up at 9.10 am. I go straight down to the lab where I am collared by an anxious university visitor. He tells me all the gory details of how the laser broke down the evening before and hovers expectantly while I inspect the damage. I decide that all the mirrors will have to be cleaned and the dye laser completely realigned, and throw him out of the lab so I can get on with it.

A laser is a sort of super light source, producing a very concentrated beam at a particular wavelength (that is, of just one colour). The light is used as a tool to investigate what happens inside atoms, and to help decide on the molecular structure. Sometimes it's used to look at huge molecules like DNA, and sometimes at others as small as H_20. A dye laser is a type of laser using a brightly coloured liquid which can be made to work at several different wavelengths.

When I go for coffee with everyone else, one of the other members of the team reminds me that we have to bring our new laser over from the other building, where it was unpacked this morning. Having collected the rest of the team, we go over the road to have a look at it. Dave goes to get another trolley, while the rest of us make sure the laser is firmly attached to the table. When he gets back, the fun starts. Moving a 6 ft by 4 ft metal table, with a laser weighing the best part of a ton attached to the top of it, down narrow corridors and round sharp bends generates quite an audience, but they tend to be much better at giving advice than actually pushing! The paintwork on the corridor walls will never be the same again, and we only took a small chunk out of the door frame . . . By the time we finally get the laser into position, it's lunchtime and we're all shattered!

After lunch I finish lining up the dye laser while Graham gets on with installing the new laser. I finish at about coffee time, and let the university people back into the lab so they can get on with their experiment.

After coffee I go to see our Project Engineer to discuss the final details of the new labs we've just moved into. While I'm there, he gives me the new signs for the doors. This reminds me that we haven't got the "Laser Hazard" signs up yet, so I go down to Safety Section to get some. They let me have a look through the warning signs, so I pick up some "No Smoking" signs for the doors as well. While I'm there, I return a copy of the Chemical Hazards Handbook that I borrowed to check on some of the dye laser solvents we use. By the time I've stuck the signs on the doors, and answered a couple of last-minute queries from the university people, I just have time to grab my coat and catch the bus home.



Photograph courtesy of Rutherford Appleton Laboratory

Jan Szechi lining up the dye laser. Jan has a BSc. in Chemical Physics. Shortly after this photo was taken Jan took the summer off to have a baby.

A Day in the Life of...

A Medical Physicist

I work in the Medical Physics Department of a large teaching hospital. The department has several sections which provide scientific support to help with the diagnosis, treatment and care of patients. My section is concerned with the radiation safety of hospital staff and patients. We measure the amount of radiation they receive and also monitor the equipment and surroundings. Our techniques can involve using x or gamma radiation, ultraviolet waves, microwaves, or lasers. Each day my work is divided between radiation physics, research work and administration.

This morning I arrive at 8.15 a.m. earlier than usual, to set up equipment to monitor staff who have been exposed to radioactive iodine. A very sensitive detector is used to measure down to about one five-hundredth of the allowable levels in the body. I carry out measurements on four people during the course of the day and none of them has even this small amount.

During the morning, a colleague from a local university and I discuss a joint research project aimed at producing a computer-based system to analyse x-ray images of patients. This is for a specific screening programme being carried out locally as part of a nationwide programme which will produce over a million images per year, most of which will be normal. It is hoped that this local work will enable the "normals" to be identified easily and quickly. The few patients who do show some abnormality can then be referred to a specialist for further examination and possible treatment.

Today I have a working lunch because there is a meeting to discuss the building of a new nuclear medicine department which is to use radioactive materials for diagnosis. Such departments have to conform with strict safety legislation and we advise on the safety measures which are necessary.

Dr Penny Roberts, Medical Physicist, measuring the radioactivity in a member of staff. Penny's qualifications include a BSc in physics, an MSc in radiobiology and a PhD in radiological physics.

Part of my job involves supervising postgraduate students. During the afternoon I help one student to set up a new type of radiation detector and leave him to make measurements of the output of an x-ray machine. This is part of a programme which enables us to measure the operating characteristics, such as the kilovoltage, of x-ray machines used in other hospitals. His project is the final part of a course leading to an MSc degree and involves making a device to identify the filtration in x-ray tubes.

Jonathan, a junior medical physicist in my section, is on a training scheme and as part of this he is undertaking a research project. Late in the afternoon we discuss his progress and plan the next stage of the work. He is developing a technique for use in diagnostic radiology whereby bone and muscle tissue, which absorb x-rays quite differently, can be seen equally well on the same film. This can be done using computer-controlled equipment but unfortunately this is expensive and not always available in the Health Service. The technique which he is developing should enable any hospital to produce images giving similar information to that generated by the computer at a fraction of the cost.

Finally, before I go home, I deal with a special request from the National Radiological Protection Board for general information on radiation doses received by hospital staff. We monitor about 7000 health service staff and because of safe working practices manage to keep radiation doses very close to background levels. While the computer is producing these data, I sort through the day's post, preparing letters to leave for the secretary in the morning. Each day produces new, varied and interesting problems which make working for the Health Service very rewarding.

A Day in the Life of... 10

A MEDICAL PHYSICS TECHNICIAN

I arrive at the hospital at 8.45 am and collect the departmental keys and the post from the switchboard. Then on to the staff room where my overcoat is exchanged for a lab coat.

I switch on the computer system and make a calibration check of the gamma camera. This works in a similar way to an ordinary camera except that it forms a picture of the body's internal organs from the emission of a radioisotope injected into a patient. The information is collected and stored by the computer for analysis at a later time. The images are also taken on an x-ray film. The machine for developing the x-ray is stored in the department — I must remember to clean it some time today.

I then start to prepare an injection for the first patient, but the 'phone rings. It is the renal unit doctor informing me that during the night a kidney transplant had been performed and they need to know urgently how well this new kidney is functioning. I check the diary but see that our camera is fully booked all day. I tell the doctor that his patient must come to the department now and we will try to fit him in before the first patient arrives at 9.15 am. A busy day ahead!

Medical Physics Technician, Usha Raval, at the control panel of the gamma camera. Usha has an HNC in Medical Physics and Physiological Measurement.

I set up the computer with the patient's name and hospital number, using the pre-set study to look at the function of the kidney, whilst another technician finishes preparing the injection. The Sister gets the patient's records.

The transplant patient arrives at the same time as the 9.30 am patient, who happens to be a little 8-year-old child with his mother. The only way I can see to solve the problem is to explain the situation to his mother and ask if they would mind waiting 20 minutes because of the urgent case. They agree.

I finish studying the transplant by 10.00 am and go on to do the analysis; suddenly I am asked to come back to help with the child, who is not keen on the injection and therefore wants to get off the bed. Another technician and I hold him so that the Sister can inject.

The morning has gone and it is now lunchtime. As I am due to go to the X-ray Department to do a urodynamic study, which starts at 1.30 pm, I have time for a short lunchbreak before going to set up the video computer system. This study involves the patient's bladder being filled with a special solution and then emptied. During both of these phases, pressure changes are recorded by an electronic manometer, and x-ray pictures show what is happening in the bladder. I take care of the video recorder and chart recorder which show the pressure changes. I call these out to the doctor. Some patients have no control over their bladders and the filled fluid comes out onto the floor!

A picture from a gamma camera study. After injection of a radioactively labelled agent, the camera shows that both kidneys are extracting the agent from the bloodstream and are concentrating it in the bladder normally.

At last it is 5.00 pm and time to go home. The computer is switched off and the lab locked but then the porter brings some blood samples from the Research Unit. These have to be put in the radioactivity counter as the results will be needed tomorrow.

5.30 pm. I will have to run to the station to get the 5.45 pm train home. I hope tomorrow will be an easier day.

A Day in the Life of...

A METEOROLOGIST

Meteorologist, oceanographer, computer programmer, saleswoman — that's me. When I arrive at work I never know which hat I'll be wearing.

My job is concerned with forecasting. No, not the weather, but the height of waves on the sea. To do the forecast I use a computer which speeds its way through thousands of mathematical calculations to arrive at the answer to: "What will the wave height be tomorrow and the following day — off Cornwall, Canada, or even China?".

Among those who make use of these forecasts are the commercial shipping companies which want to know the predicted wave heights over a wide area so they can select the best route for their ships to travel. They are concerned that their ships' cargoes should not be damaged by high waves.

Off-shore oil companies also need to have information on wave height and periods as some of their operations are weather dependent. If, for instance, they want to tow a rig into position in the North Sea they need to be able to choose a time when there will be a fairly long period, say two or three days, when the wave height will be low — a so-called "weather window".

First thing this morning I am solving 'bugs' in last night's computer jobs. Suddenly my boss points out that the wave height off Norfolk today is lower by 0.4 m than was predicted yesterday and he wants to know why? Off I go to see Arthur. He used to be a ship's captain and therefore uses his experience to look at the weather and deduce wave heights. He agrees that the present height is likely to be only 2.5 m so my forecast, it seem's, wasn't too good!

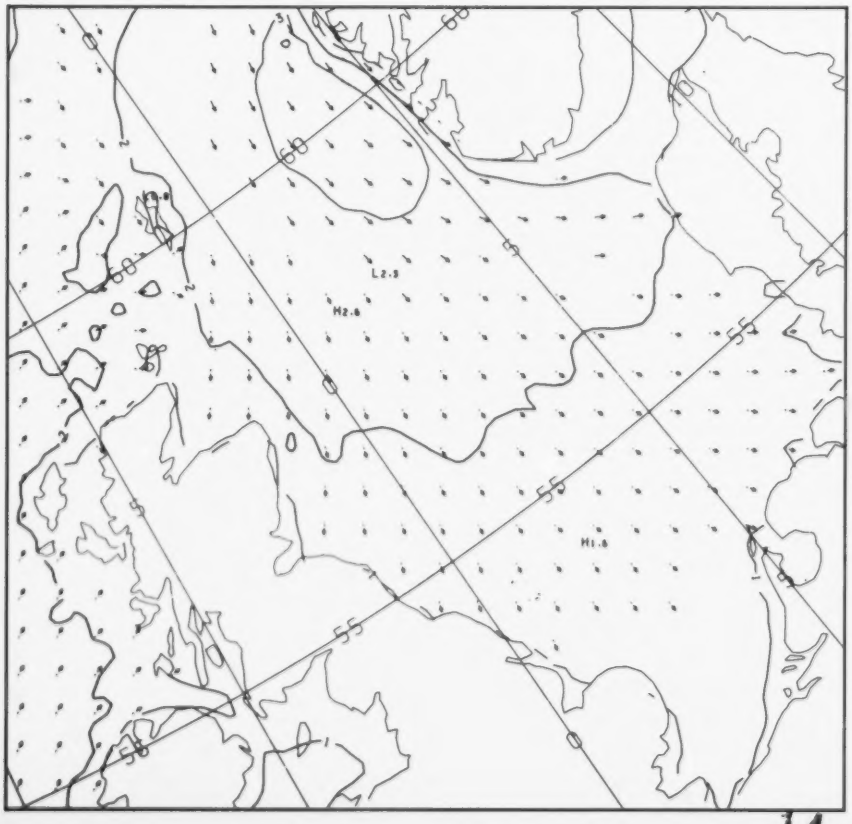
Meteorologist Claire Bracher at work. Claire has a BSc in Physics and Meteorology.

Instant swap into meteorologist/oceanographer. If the winds are lighter than were expected then my waves will be too high. Kathy, however, says that the predicted winds are about right: try another solution. Wave heights and tides interact, so if Ian next door says there is an unusual tide then that would explain my poor forecast. But before I can pursue this, Wendy asks for a sympathetic ear to listen to her computer problem. It is uncanny how program bugs can become so obvious when you describe their symptoms to someone else! It's a good tactic — try it.

Lunchtime already and I'm in danger of being late for my swim.

The afternoon looks destined to be a "programmer" one, but that is soon foiled. A researcher for an oil company which wants to rebuild an on-shore oil terminal 'phones to enquire about wave data. He needs to know what sort of wave heights and winds are to be expected in a certain area around the coast of south-west Ireland. I tell him how our forecast is done, its strengths and its weaknesses. In the end I promise to send a letter giving a detailed explanation and some examples of data for a selection of places within his region of interest. One day I hope he will be another of my "satisfied customers".

By now it is 4 o'clock. I have enough time to submit various jobs for the computer to run overnight; then when I arrive tomorrow morning I can start to study the Mediterranean immediately. Well, that's the theory, but didn't I plan to do that today?



A wave height forecast chart for the North Sea on midnight 20 July 1986 made 12 hours previously. The contours are the wave heights in 1 metre intervals; the solid arrows show the wind direction; the dashed arrows show the "swell" direction.

A Day in the Life of... 12

An Optics Consultant

I am a Senior Engineer with a firm of scientific consultants. My company undertakes research and development projects for a large number of clients who range from very small to very large companies. The group in which I work has around 12 people and concentrates mainly on projects involving the use of lasers and optics. (A laser is a very bright light source which produces light of a single colour in a pencil-like beam). At any time I am usually working on between two and five different projects, each one lasting anything from a few weeks to a couple of years.

It is difficult for me to describe a typical day as each one is different. I usually arrive at the office somewhere between 8.30 and 9.00 am, although I may have popped in earlier to switch on some equipment and then gone home again for breakfast. Some days I have a meeting with a client at the client's office, in which case I may set off early if I have a long way to drive. The purpose of such meetings is usually to discuss a project in progress or to present the results of a recently completed project. Sometimes I am invited to a meeting with potential clients to describe the kind of work which we do and to discuss how we may be able to help their business.

Karen Ness at work adjusting an experimental test rig developed to measure position using a beam of laser light. Karen graduated in physics then gained an MSc in Applied Optics. She is currently working on her PhD thesis.

If I am spending the day in the office, then the morning might start with a short meeting with some of my colleagues to discuss the latest developments of a project and to plan the following week's activities for that project. Most projects have at least two or three people working on them at any one time, with each one having its own team, so I often find myself working with a large number of people throughout the day. Among the 400 people working in our building we have experts in many different fields, including mechanical and electronic engineers, biotechnologists, materials scientists, even food technologists, as well as physicists. Many projects involve people from these different groups working together; I find this very interesting. At the other extreme, I am the only one working on one current project!

Typically, I spend about half of my day in the laboratory doing experimental work and the other half at my desk in the office, writing reports or letters, or in meetings. Sometimes I may spend a day or two working with colleagues from outside the company who are collaborating with us on certain projects: in that case I may go and work in their labs.

One of the projects I am working on at the moment involves an ultraviolet laser — the light from it is not visible — to be used by doctors to treat certain eye conditions. Another uses a laser which produces blue light to make a special kind of optical component. I find these projects using lasers in ophthalmology (medical study of the eye) very exciting. We are currently developing a method of performing surgery on the eye using lasers, so that in the future people will, hopefully, no longer need to wear glasses or contact lenses. To do this, I am involved in designing and testing a delivery system which transports the beam from the laser to the eye. This is particularly interesting as it gives me an opportunity to work alongside doctors and biologists as well as physicists.

If I have a meeting with a client over lunchtime then we usually have a working lunch. Otherwise I go to the canteen with my colleagues — a useful opportunity to chat generally and catch up with their projects. The afternoon passes like the morning — a busy programme of meetings, lab work, project planning and report writing. Sometimes I get time to spend thinking about new ideas for projects or catching up with recent work published in the physics journals.

Normally I finish work around 6.00 pm although I am sometimes still in the office later than that, especially if I have telephone calls to make to the USA, which is between five and eight hours behind us in time!

A Day in the Life of... 13

A PATENT AGENT

I arrive in my office at about 8.20 am — an early start, mostly to avoid the rush-hour build-up of traffic, but also because I find I can think more clearly in the mornings. I look at a patent specification which I started writing the day before. It is based on a write-up of a novel electronic device by a scientist in the company's research laboratory. Patent agency is a combination of science and law — the idea is to draft documents, called patent specifications, which effectively impose a monopoly, for a limited period, on the exploitation of an invention such as this novel electronic device. To do this, patent specifications include statements, known as claims, which define the invention which the patent, if granted, will protect. It is therefore important to identify the essence of an invention in such a way that the claims do not describe what is already known, but do include possible variations, which somebody may use to try to "avoid" the patent.

In reading through the claims of the patent specification I begin to wonder if all the leads to the electronic device, as described by the inventor in his write-up, are strictly necessary. I decide to arrange to see the inventor in order to discuss this with him. Patents normally involve only reading and writing, so I enjoy going to see inventors as it is an opportunity to get out of my office.

Whilst I am sitting in the inventor's laboratory drinking a cup of coffee, one of his colleagues spots me and comes across to ask whether I think one of his latest ideas for a new form of semiconductor processing technique is patentable. At face value his idea seems very different from the usual semiconductor processing techniques, and I ask him to check whether his laboratory manager considers a patent application would be commercially worthwhile and, if so, to provide me with a write-up describing his technique.

It is now lunchtime, and I lunch with a new colleague in my department who is in the middle of studying for the first of the law examinations set by the Chartered Institute of Patent Agents in order to qualify as a patent agent. These examinations are regarded as quite difficult, and most of the work for the examinations must be done in a trainee patent agent's own time, although the Chartered Institute of Patent Agents does run a series of lectures and tutorials to help. My colleague asks me a question about a point in US patent law which has been puzzling him — as we prepare patent specifications for use in various countries it is necessary to have a general knowledge of most countries' patent laws in order to pass the examinations and also for use in day-to-day work. I am able to direct him to a book which will clear up this point.

Dr Janet Smith is a Chartered Patent Agent and European Patent Attorney. She has both a first degree and a doctorate in physics. She is shown here discussing the claims of a patent specification with the inventor.

When I return to my office, a friend who is a patent agent for another company 'phones to ask if I am going to a "moot", a kind of mock law hearing organised by the Chartered Institute of Patent Agents. I am, and arrange to meet her there. Patent agency is one of the smallest professions, with about 1500 qualified patent agents in this country. The Institute organises a number of activities to ensure that patent agents and trainees have lots of opportunities to meet and discuss patent matters.

My friend's call is quickly followed by a 'phone call from the technical director of one of the manufacturing units of my company. He has discovered that a rival company has started to produce an electric fan which seems to him to fall within the scope of one of the patents originating from his unit. We decide that the best immediate course of action would be to obtain one of the offending fans for me to look at to ascertain whether he is correct, and then to decide what to do next.

I settle down to finish off the patent specification for the novel electronic device in the light of my morning's discussion with the inventor when there is a further telephone call from a chief engineer in another of the manufacturing units. His division has been offered a contract to produce a particular form of electronic display. However, he is worried that another company, which he knows to be working on the same form of display, may have patents protecting it. I agree to do a search using our computer terminal to find out whether any patents or patent applications covering the display have been published. Our computer terminal is connected to a database in the USA and is capable of very quickly giving information such as a list of all published patents or applications worldwide covering a particular subject. I do the search and find that the company he is worried about does not appear to have any published patents or applications covering the display, although there is another company which does appear to have such a patent in the USA. I 'phone the engineer back to tell him as he may find the patent of technical interest, although it will not worry him as he does not expect his company unit to export the display to the USA and patents are, in general, only effective in the particular country in which they are applied for.

It is now time to go home, and I quickly place on my desk, in order of urgency, the documents I will look at the next day. I then venture out to brave the rush-hour traffic again.

A Day in the Life of...

14

A Physics Lecturer in a University

Sunshine warrants cycling to work and I get in at about 8.00 am. I make my way to the lab, where I dismantle the pressure cell and put away the semiconductor sample I had been using for electron transport experiments for the last two weeks.

When finished, I leave a note for our technician on a new sample and the pressure gauge, asking for them to be assembled into the cell and brought up to 10 000 atmospheres. I leave a note for my research students on new references and new equipment specifications, then dash to my office where I collect a couple of MSc students' lab reports, various preprints (scientific papers reporting new results prior to publication) and other paperwork. I make my way to the test room: today I am one of three lecturers supervising some students doing a written test — not much fun for the students! We take it in turns to oversee the students who work hard on the questions set. When not supervising, I mark the lab books and read about new findings on layered semiconductors — the layers are so thin that the electrons behave as if they were in two dimensions! I jot down some notes, then flick through a scientific equipment magazine and write a letter to a colleague in New Zealand, to tell her of new references on solid state physics which will help her with preparations for her new course on electronics. The test is over and I meet my friend for lunch (a somewhat special occasion since he will be abroad for a while).

Back in the lab, the technician and I discuss what he has been doing and we both check the pressurised cell. The sample still conducts and looks okay. We lower the pressure cell in the cryostat, which is a container of liquid helium kept at −269°C, keeping an eye on the sample's electrical resistance. Leaving him to get on with it, I spend some time with my research students. With one I discuss the pumping system of his optical cryostat; with another, some of her new results on the interaction of laser light with the crystal under study — these look very promising and I encourage her to write down a summary. Another student and I talk about ways to get a clearer signal from his equipment so that we can see the rather weak changes in the resistance of his sample as the magnetic field applied to it increases.

My own experiment is ready to run; one final sample check at low temperature then I get started around 3.00 pm. A colleague pops into the lab to remind me of some essays that have to be marked and returned to him soon. The experiment goes well, but the changes I had expected in the current through the sample as a function of the voltage applied to it are still small at that pressure. The trend is in the right direction (which will please my industrial collaborator), but, to see clearly the effect of bringing the atoms closer together, I may need to take the samples to a central research laboratory in the south of England where higher-pressure equipment is available.

University lecturer Dr Clivia Sotomayor Torres was educated in Chile but pursued her university studies in the UK. Her qualifications include a first degree and a PhD in physics. In the final year of her PhD Clivia was awarded an Amelia Earhart Fellowship by ZONTA International (a USA-based organisation for women in business and the professions).

It is almost 7.00 pm: I retrieve the cell from the cryostat and leave it to warm up to room temperature at its own pace. I dash to my office and collect some papers relating to an international four-day research meeting on very thin semiconductors which I am organising. The list of speakers and the programme of the meeting both need revising so I'm taking the papers home. Half-way home I remember the famous essays. Oh well, they will have to wait one more day.

A Day in the Life of...

A PHYSICS TEACHER

"Where's my recorder?"
"Have you got your shoes on yet?"
"Who's pinched my brush?"
"How many times have I told you . . ."

Why is it, I ask myself for the hundredth time, that I can organise a class all doing different experiments at the same time but trying to organise my own two children to get to school on time, and with all the right equipment, always seems to turn into chaos?

Eventually we all get where we should be, the children to the village junior school and me to a local school where I am a physics teacher. Just time to grab a cup of coffee before the Upper Sixth lesson. (We are looking at the formation of stationary waves.) They begin by working their way through a development question which will give them a good idea (I hope!) of how such a system of waves is formed. I have given them a list of textbook references and expect them to be able to work independently and to ask if they are having problems. While they are doing this piece of work I take the opportunity to talk to one or two of them about their applications for courses at university. One has got an interview at a university the following week and we arrange to meet later in the week to go over topics which might crop up during the interview. The group now have some idea of standing waves and we set about testing their understanding by investigating experimentally the factors which affect the standing-wave pattern in a stretched string. The lesson ends and I walk across to the staffroom for break and another welcome cup of coffee. While in the staffroom, I check with Ann, the Director of Studies, when she will be expecting me to give a series of lectures to the Sixth Form as part of their General Studies Course — all the sixth form follow a course of lectures which are intended to give them a broadly based appreciation of important social issues in Humanities and Sciences. I also have a word with the music department about recording some solo instrumentals to form part of the Hearing and Sound course for the Third Form. Dorothy gives me a gentle reminder that she needs a list of exams for the upper school by tomorrow and I make a mental note that I must do something about the Third Form exam paper needed in three weeks time. Why is it I never get time to sit down at break?

I am not teaching after break, so I take the opportunity to go over to the Computer Room to play with the new program which arrived in the post. It looks good fun and I have an idea where we can slot it in to the syllabus. The bell sounds and I realise that the Third Form will be eagerly waiting for their end-of-unit test on Energy. When they have finished their test, with much wailing and gnashing of teeth, I give them back the project reports they wrote up on the topic of "Friction, Friend or Foe?". We spend the rest of the lesson discussing what has been learned from the project and how they will tackle the next one in the light of experience.

All too soon (maybe not soon enough for the Third Form!) the bell goes for lunch and the kettle is filled and switched on to provide yet another cup of coffee. While the kettle is boiling I have a look at the prototype version of the A-level practical which Bob has put together from the Examination Board's instructions. (Bob is my lab technician and a very precious possession. He actually understands the insides of the multitudinous black boxes I have in the lab.) As usual, the apparatus does not appear to work as intended and I make a note in my little black book to ring up the Board to query the instructions they sent us. Over my ....th cup of coffee and an orange (I'm on a diet . . . again!). I discuss the new set of worksheets I have produced for the Fourth Form Electric Circuits topic with Mr Kirit, who will be teaching it at the same time. There are a couple of ideas that he isn't happy with which will need rewording. Thank goodness I have now mastered the VIEW wordprocessing system on my BBC micro and can call up the appropriate worksheets and amend them without having to type the whole lot out again.

Lunchtime is over and I have an appointment to see the Bursar to discuss the physics budget for next year. I intend introducing electronics, as a fortnight's course, into the second year and to gradually build on this by similar courses in the third, fourth and fifth years. This will need a fair outlay of capital and we need to talk over various ways of financing the scheme. This is always a difficult aspect of my job as I have to have a very clear idea of my priorities, including leaving enough money to cover the everyday running costs of the department.

My last class of the day is the Fifth Form, who are following a science course based on the Nuffield 13-16 scheme. Everyone has to take at least one science subject and the less scientifically-minded often opt for this broadly based course which has an element of continuous assessment; that is, they can accumulate up to 50% of the marks on a number of assessed practicals and topic tests before the final examination. We are just finishing off a section of work concerned with the physical and chemical properties of metals and how these properties suit the metals for different jobs. Over the last few weeks we have managed to accumulate quite a collection of "junk" showing the use of metals for different purposes and the task of the girls today is to design a table or chart which will best display the information about the metals. Most of them have draft versions ready by the end of the lesson and I remind them that I shall want the final versions in by Friday so that I can mark them over the weekend.

Back in the prep room I try to remember what it was I promised Eileen, the Head of Biology, that I would do before the next day. Oh yes! We need to put forward a joint science policy to the Headmistress, concerning the introduction of practical assessment at all levels into the curriculum. This will have serious implications for equipment, technician time and lab space, so I shall have to do some hard thinking. I also take home the Fourth Form worksheets which need amending and the Third Form test which needs marking before Friday. Once the children are in bed . . .

Sheila Saville has a degree in aeronautical engineering. Before entering teaching Sheila did a one-year Postgraduate Certificate of Education.

A Day in the Life of...

16

A Product Marketing Engineer

The day begins at 6.30 am when the alarm goes. By 7.00 am I'm on the road to our Head Office in central London. I like to get in early and have an hour's work alone before the 'phones start ringing at nine.

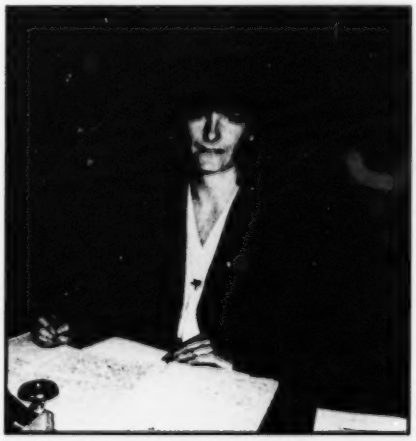
Being a product marketing engineer for radiation measurement devices for a large multinational company is quite demanding. I am totally responsible in the UK for my product range both commercially and technically. I have to define the marketing policy (that is, decide where my target markets are), ensure I have the correct products to meet market demands, investigate and define new products and manage their introduction into the market place, know and understand the competitors, set prices and initiate the appropriate level of promotional support. I also help to decide on the factory's planning schedule, set stock targets and represent the national company at the international meetings.

In my field, because it is so specialised, the company sales engineers do not have the technical expertise needed to sell my products so I have to do this myself. This involves face-to-face technical discussions with the customer and, I hope, persuading them to use our products. This can take from a few months to a few years depending on the complexity of the problem. Customers are either equipment manufacturers or research establishments. This is one aspect of the job I thoroughly enjoy. It keeps me in touch with the scientific community and it can be very rewarding and satisfying when my products are chosen instead of a competitor's.

Because my responsibilities are so varied, a typical week would involve three days visiting customers, one day in the factory to keep in contact with developments and problems, and one day in the office. No two days are the same; however, I do form a slight routine when in the office — I have seven hours in which to clear up a week's paper work. I start by opening my mail and dealing with those enquiries which do not involve much work — respond to telex, that sort of thing. By nine my "in" tray is half empty, my list of "things to be completed" is in order of priority and I can now start to chase up the problems.

A typical problem is production capacity. The customer wants the goods now but can I deliver? I have to chase the factory staff to see if I'm getting my full month's allocation and when. Once I get that information I can pacify the customer with guarantees of delivery or give him a clear indication of when he can expect his order. Today I had such a problem. The factory had not delivered a particular product for two months so I spent a full hour putting on pressure, and finally got a promise of delivery in two weeks' time. Other related problems include goods lost in transit and goods sent to the wrong customer — these are problems which should not be of concern to me as we have other departments dealing with this, but I always get involved. What is important in the end is service to the customer.

I find that when I am in the office there are a lot of people from other departments who need to talk to me. I always go up to the sales desks for half an hour or so to clear up outstanding items. I always seem to be in great demand there but most queries can be dealt with on the spot. I then pop along to the purchasing department and check whether we have any delivery problems which I can take up with the factory when I'm next there. There usually are some problems.



Caroline Lismore-Kerr followed her degree in physics with a one-year postgraduate course in production management.

By the time I get back to my desk there are normally a few messages. I deal with them immediately. It could be audit control, a customer with a technical enquiry, the sales desk again, or perhaps one of my European colleagues.

Just before lunch the 'phones quieten down. There is time to write my reports of customer visits and to check to see if I have done what I am supposed to have done. There may be letters to be written informing customers that certain products will become obsolescent; they may wish to place one last order before production stops. There may be an exhibition coming up so I formally invite people enclosing an entrance ticket: there are always exhibitions and this jogs my memory that I have to go and see my publicity people about another one. I have to give them the details, get them to book me space and eventually, when I have time, prepare the information for the stand. I then remember that I must ask the secretary to book a hotel for one of my overseas colleagues, who is coming to England for an exhibition.

Entertaining is a big part of the job. It is great fun but bad for my waistline if I'm not careful.

After lunch my manager catches me. He needs to be kept informed about what I'm doing and of any problems. This chat normally lasts an hour for there is always a lot to say and several problems to solve.

By the end of the day I have done a lot, talked a lot, moved about a lot. I look at my list to check if all has been completed. Usually I have managed to complete about half of what I had set out to do! Tomorrow I'm out visiting two different customers and so I'll have to wait until the following day before I can come in and clear the backlog.

It's all good fun, even if it is intensive at times. The golden rules are to enjoy what you do, do it well, don't let it get you down when you are under pressure, and never ever take work home. I follow these rules and I am happy in what I do.

A Day in the Life of...

AN RAF FLIGHT SYSTEMS TECHNICIAN

Work for me can start at any time (usually very early) depending on the aircraft flying programme for the day. I start at 7.30 am today and as soon as the Jaguar aircraft are towed out of the hangar I begin aligning them. This is a fairly simply task which involves applying electrical power to each aircraft, entering the aircraft's position (latitude and longitude) through the inertial navigation unit (INU) and turning on all the navigation equipment to check that it is serviceable. I usually finish this task only shortly before the first wave of aircraft is due to take off as there can be up to 15 aircraft to align. Today I have only 10 aircraft to align, so I finish in good time.

The first wave is due to take off at 9.00 am. I wait in the "line hut" until all the aircraft have taxied, just in case there is a "crewing snag". This would mean that the pilot is having problems, perhaps with his navigation equipment, and needs assistance quickly if he is to continue.

At last all the aircraft have gone and I return to the hangar. Time to do some rather mundane tasks now, and everyone lends a hand to sweep the hangar floor, tidy loose electrical earth leads away and dispose of waste oil that has dripped from the aircraft overnight. There is no work left over from the nightshift, so I find time for a quick coffee before the aircraft are due back and the pilots start to radio in their snags.

One pilot reports a flight systems problem and I go out to the line hut to debrief him as I need to know all the symptoms of the fault in order to decide what is causing the problem and which line replaceable unit (LRU) will need to be replaced to cure it. I listen carefully to the pilot and ask as many questions as I can; this time an INU needs to be replaced. With assistance from a corporal, the unserviceable INU is removed, and the new INU is fitted; we then apply ground power and test the system functionally, checking carefully that all the symptoms of the fault have gone. I complete my paperwork and the corporal signs it to certify that I have carried out the job correctly, and that the aircraft is ready to fly once more.

Time for a short lunchbreak and a trip to stores in the squadron Land Rover to return the unserviceable INU.

The flying programme is quiet for the afternoon so, working as part of a team, I help to do a "harmonisation" on the weapons system of an aircraft that has bombing problems. It takes a while to make the small adjustments that will mean that the bombs and guns will be on target. We are not the only trade involved and there is plenty of friendly banter before we complete the task.

I hardly get the paperwork signed when a pilot radios in with a problem. After a debrief I go out to the aircraft to verify the fault but can find nothing wrong and have to complete the paperwork accordingly. Pilots often have "finger trouble" (where they may hit the wrong switch or fail to switch something on), because of the heavy workload they are under when flying, but all reported problems must be checked.

After getting soaked in a downpour while out at the aircraft I'm glad to return to the hangar and shift changeover. Time to pass the rest of the problems to the next shift and then go home.

Susan Medland carrying out an inspection on a Jaguar aircraft. O-level physics proved very relevant to her chosen career. After obtaining four Scottish Highers, Susan followed various technical courses. She now has a Higher Diploma in Computer Studies and other awards in System Design and Avionics.

A Day in the Life of...

18

A REAL-TIME COMPUTING SCIENTIST

When I arrive at the testing laboratories at 8.30 am, ready to start, I first stick my head in the computer room to make sure the air conditioning has not failed again. This happens much more often than any of the computers giving trouble!

In these laboratories we test mining machinery and electrical equipment used underground such as hydraulic pumps and motors, gearboxes, coal cutting machines and electric motors, cables and cable couplers. Some test rigs run for 24 hours a day, 7 days a week, all year round. This is why computerisation is necessary, keeping "watch" all the time.

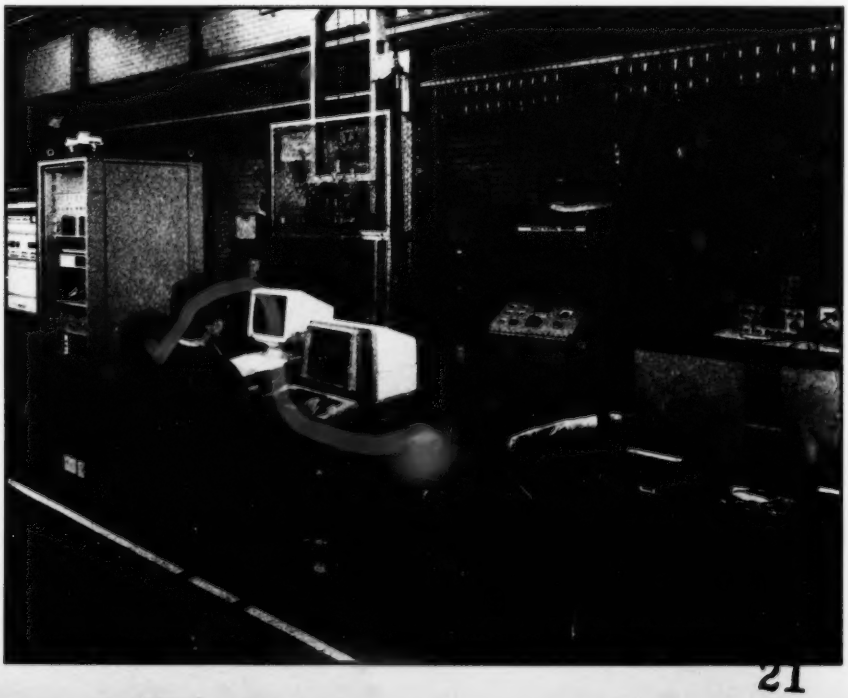
I walk across to the electrical testing lab to see if the computer system we have on-line there is functioning as it should. This test rig is for testing cable couplers which connect the large cables carrying power underground to the massive mining machinery used there. They carry high electrical currents and so have to be tested when the design is changed to ensure that they will not "blow up" in use. The test puts a varying current load on the couplers and the computer monitors the currents, voltages and the temperatures at various points. It will "trip" (i.e. switch off) the rig if any reading higher than a pre-set value is detected, switching on a warning light as well. The computer also records all the data from the rig as and when required by the test. The engineer in charge of the test can also interrogate the computer and give it instructions. My part in this was to write the computer program to manage all these functions.

After checking that all is fine there, it's back to the office to the system that I am writing to monitor and record data on the hydraulic testing rigs — the rigs that test the pumps and hydraulic motors. The computer program has to be very flexible in terms of the values the computer reads from the rig, e.g. pressure, flow, speed, torque and temperature. It also needs to be extremely "user friendly". If an engineer can press the wrong button on a computer keyboard, he will. Therefore, everything the person using the computer puts in has to be checked by the computer before it is finally accepted, thus making the programs very long and complex. The system should also run without any need for me to be involved once the users have been shown how it works.

I just get well into the work when the 'phone rings. It's one of the engineers who has a desktop computer to say his new printer has arrived and can I go and sort out the cabling for him? This takes about an hour before I can get back to my work on the hydraulic system. The 'phone often rings or someone comes into the office with a query about one of the many types of computer we use for testing, word-processing, the generation of graphs or database management.

Before I leave at 5.00 pm I do a final round to check that everything is still working — it can be guaranteed that if any faults are going to arise they will just before 5.00 pm on a Friday, giving us a last-minute panic before the weekend.

A normal day consists of a mixture of all these activities and I go up and down the stairs to my office overlooking the main laboratory like a yo-yo!



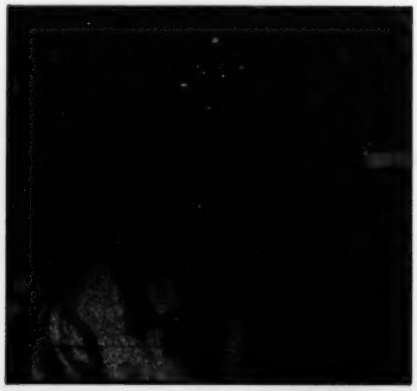
Lisbeth Boulton in the electrical testing laboratory where she works. Having first obtained a technical qualification, Lisbeth then went on to do a four-year industry-based sandwich course which led to a degree in applied physics.

A Day in the Life of...

A Research and Development Physicist

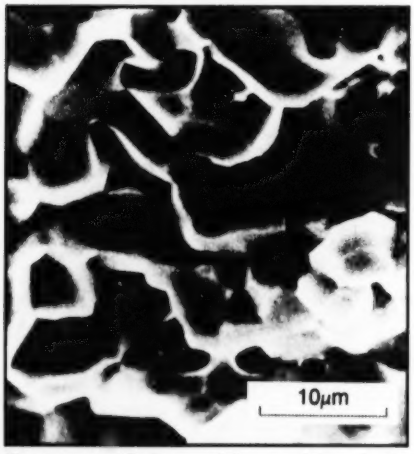
I arrive at 8.30 am at the Research Laboratory of the large electronics multinational for which I have worked for eight years. I poke my nose into the lab and say hello to Steve, our technician. He has plenty to do at present but we agree to meet at 9.15 am to decide on some measurements he has to do later. I then go and check on VERA — no, not a lady, but the variability electronic recording apparatus. This measures the drift in the magnetic properties of the components (inductors) inside it as they are taken through a series of temperature cycles. The chart recorder suggests that the equipment functioned as required overnight and I type a few details into the computer terminal so that the results can be processed straight away.

Then it's along to the office for the inevitable "in" tray. There is typing to be checked and several reports to be read. I don't make much of a dent in it before Steve arrives. We look at his results; they show that the new transformer material we are investigating is promising, but rather inconsistent. We have to report on it next week to our UK and overseas development team, so we have to be sure that it is the material and not our measuring technique which is inconsistent! He goes off to wind some different wire round the rings of material and to check their energy losses at the suspect frequencies. I get a call to go and meet some visitors at reception.



The new arrivals are George, from Head Office, and a couple of customers with problems; we meet with my group leader and the rest of the team. It looks as if our components don't like what our customers are doing to them so we discuss some tests to try to isolate the problem. Having thrashed this out, I tell them about some computer programs the company is developing which may be able to help them with their design problems. It's lunchtime when we finish. I'm not taking the customers to lunch this time, so head off for the canteen.

After lunch I pick up the VERA output from the computer department and settle down with it and other results to write a report for the meeting next week. That takes me a couple of hours, and then I'm off to the scanning electron microscope for the last part of the day. This work I really enjoy. Apart from the chance to have a chat with Daphne, who operates the machine, I just love looking at materials closely. Even the scruffiest bit of dirty grey ferrite looks beautiful when magnified many thousands of times. We are trying to use some cheaper raw materials in production and I'm looking to see if the change is affecting the ceramic structure. We get some interesting photographs and I ask Daphne to do some impurity concentration profiles on the samples. This will show me if the impurities are spread evenly throughout the samples or if there are high concentrations anywhere, which could be the cause of the poor ceramic structure we are seeing.



Ferrite magnified several thousand times by the scanning electron microscope.

By the time we finish there is just half an hour to help Steve set up VERA for another run tonight. I explain that we'll have to drop everything tomorrow and try and sort out this customer problem. The customer always comes first!

Dorrie Giles, R & D physicist, qualified with a BSc in applied physics.

A Day in the Life of...

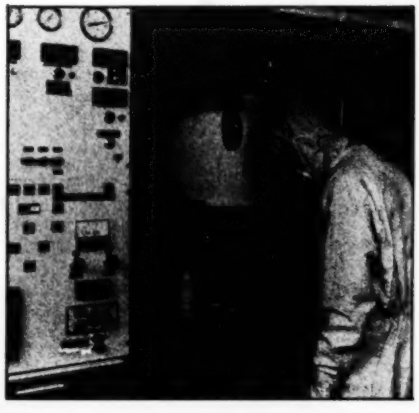
A Research Director

The alarm goes off at 6.30 a.m. The first job is to wake up my two children, James aged 9 and Erica 6. I may be home late tonight, so it's important that I have my half hour with them in the morning.

I am assistant director of a research centre in a large electronics company. The work of the centre is very varied, ranging from telecommunications to materials science. My special responsibility is for research into silicon technology, and has two main aspects. First, I have to ensure that the current research programme is carried out to the satisfaction of our customers – I do this by communicating regularly with the laboratory managers and project leaders in order to sort out any problems which can (and do) arise. Secondly, I am responsible for making sure that we have the funding that will allow us to continue with our research work next year and beyond. This involves talking to our customers and to government departments such as Trade & Industry – in fact, to any organisation which might provide us with the money we need.

I drive in to work in my company car – the journey takes about an hour. Today I arrive at 8.00 a.m. for a breakfast meeting with my fellow assistant directors: there are five of us in all. The company is building a new research centre and we discuss how this might affect our 600 research staff.

I am at my desk by 9 o'clock and the first thing I do is make a list of everything that has to be done. Then an hour or so is taken up with 'phone calls and administration. By 10 o'clock at least three people have popped up to see me, each with a different problem.



A "clean room" in operation.

Mid-morning I sign "batch" forms. Most of our research and development of silicon integrated circuits involves processing numbers of wafers. Wafers are thin slices of single crystal silicon, which are optically polished: they are then processed in batches of 25, and in order that the research is carried out in a controlled and reliable way, each batch has a set of process instructions, which I must check and then sign.

At 10.30 a.m. there is a meeting with our main customer, an electronic devices company. We report to their representatives regularly every month, giving them a detailed written report as well as talking over problems. I spend a lot of time reading through and approving these reports. At the meeting we discuss the research programme, arguing out the adjustments both sides want to make. We have to make a change to the planned programme as the market situation has altered and we have made a significant breakthrough in the research.

Lunchtime is spent entertaining some other visitors – colleagues from America who want to go to a traditional English pub. As I am on the council of the Women's Engineering Society, and believe women should be continually encouraged to enter the world of science, I sometimes spend my lunchtime giving a talk on this subject. Recently I gave a talk to the women's group here at the research centre on managing both a career and a family. I also give talks in schools from time to time.

Today, the meeting with the electronics company continues well into the afternoon. Once the visitors have left, my managers and I discuss the actions which have arisen from the meeting, and then discuss how to tackle a technical problem: – one of the process steps used regularly is giving non-standard results so someone needs to find out the reason and suggest a solution.

Assistant Director of Research, Dr Eileen Read has a degree and a doctorate in physics.

Each project has a strict plan and a detailed schedule, with a work programme for every week. It is very important that I see everybody involved regularly, in order that the plan is kept to and deadlines met.

At about 4 o'clock, I pop down to the "clean room" to see how things are going. This is an ultra-clean area (i.e. there is hardly any dust) in which the silicon and gallium arsenide wafers are processed, and where the "grass roots" activity of research and development takes place. I am on the look-out for any specific problems: perhaps some equipment has broken down, or urgently needed material has not arrived, or a member of the night shift staff hasn't turned up. Some days I cannot make this visit, as I am dashing off to Heathrow at about this time to catch a plane to Brussels or perhaps Paris for a meeting with our European collaborators.

Today I leave work at 5.30 p.m., and arrive home with just enough time to change before I go off to a parents' evening at my son's school. So ends another busy day packed with problems, challenges and (thankfully!) rewards.

A Day in the Life of...

21

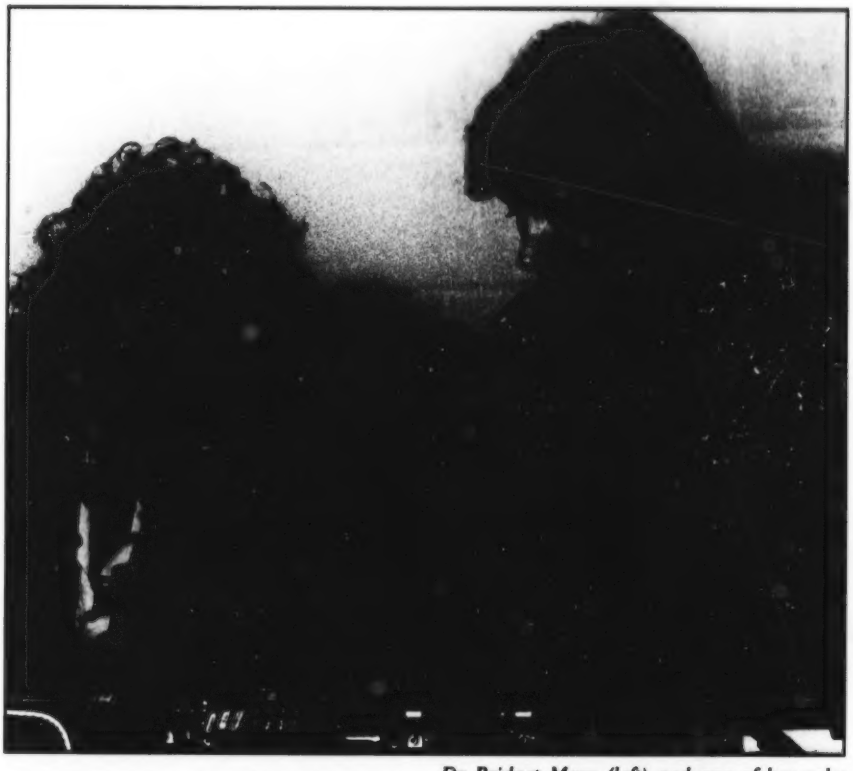
A SALES/MARKETING MANAGER

No day is typical when you're dealing with people. The company that I work for makes and sells lasers for science, medicine and industry. We have many hundreds of customers and each one has different problems, different needs. Most days I spend a lot of time talking to customers, either on the 'phone or face-to-face. As UK sales and marketing manager I spend most of my time in the office; as a sales engineer I used to spend at least three days a week out of it.

On the day to be described I should have been in Germany attending an international sales meeting at one of our companies. At these meetings we discuss new products, changes in our older products, the applications in which our lasers are used and the best way to market our product. These are generally lively meetings and I enjoy them. However, this time I've sent two of my sales engineers and I will stay in Cambridge. The European Manager is also based in the UK and, as he has gone unexpectedly to a meeting in Greece, I will stay here to cover a meeting with the German sales manager.

I leave home at 8.15 am and drop my daughter at the minder. I'm a little late picking Karl up from his hotel but we still arrive at the Science Park, where my company is based, by 9.00 am. I spend 15 minutes on my "in" tray while Karl rings his office and so we both clear our urgent problems and start our meeting. The German and UK laser markets are very similar and so we have plenty to discuss. We have recently undergone the trauma of computerising our customer database, but our German office is still considering the step, so we discuss this in great detail. We finish our discussions at 12.00 am just as the taxi arrives to take Karl to the airport. I have a sore throat and am losing my voice so I dash into town hoping for a miracle cure. I gargle and suck lozenges all afternoon.

The afternoon whizzes by as usual. A customer calls in to pick up a laser: this one is going to a discotheque somewhere. He changes his mind at the last minute and wants some extra optics. I let him take the system anyway and arrange the extra part (an extra output coupler) quickly — I'll sort out the paperwork later. A few more 'phone calls and visitors take me up to 5.40 pm when I go home. This is early for me but I have a dinner engagement at 6.45 pm.



Dr Bridget Marx (left) and one of her sales engineers with one of the lasers from the range manufactured by her company. After obtaining a first degree in physics, Bridget studied for three years to get her doctorate.

I dash home, gargle again and change quickly. Bad news on the voice front — it's gone completely. This is something of a blow as I have been invited to have dinner with the speaker prior to a lecture on holography and other laser applications at the Society for the Application of Research. At the end of the dinner I'm supposed to propose the vote of thanks. I meet the speaker at the restaurant — he is very surprised to see me as we have dined together just 10 days earlier at the Royal Institution where he was also giving a lecture. The organisers look more than surprised at my lack of voice. The lecture goes well and there is a lively debate afterwards. At the end I leap onto the stage and mouth into the microphone a vote of thanks to the speaker. Luckily the audience can hear me and think it's terribly funny, so all ends well. I am approached by someone from the audience to ask if he can visit the company in a couple of days' time to have a look at what we do. Of course I agree; just one more appointment for my bulging diary.

And so the end of another day. Hopefully a good night's sleep will set me up for another day tomorrow, this time with a voice too, please.

A Sales Office Assistant

The first job in the morning is to check the "viewdata" system to see whether there are any new messages. Our sales engineers have terminals at home and so have the facility to send us messages, enquiries, quotes, etc. It means they don't have to come into the office so often.

From 9.00 am the 'phone rings frequently: our customers have plenty of enquiries and queries. The day's work is generated mainly by these 'phone calls, so is always varied. The post is opened and distributed, and the morning soon passes.

The most common enquiry is about the price and availability of the components that we sell. Often the customer is not sure what he or she wants, so we have to find out exactly what they need, for example voltage and tolerance, radial or axial leads etc. Sometimes special approval or release specifications are needed, such as CECC (European standard) or BS (British Standard) release. To look up a device on our computer system we need a part number to enter into the VDU. We can get most pricing and delivery information, and current and previous order details, from the computer. We each have a VDU on our desk. Deliveries are also obtained from our Procurement/Planning section. Answers have to be chased up from the previous day and customers 'phoned.

We have a general knowledge of the product range, so can always offer the customer alternatives to give a better delivery promise. We each have a set of data books on the product ranges, and we also have a technical service office and the product groups as back up. There are always questions to ask the customer. Much of our expertise comes with experience, but a basic knowledge of electronics is helpful in our business.

In general, electronic technology is moving towards smaller and smaller equipment, so smaller components are required. We have to cross-reference the conventional devices with the much smaller "micromin" surface-mounted replacements and advise the customer of type availability.

Usually lunch hours are our own, but sometimes we have a "working lunch" — a lecture/discussion from one of our product groups, for example on capacitors, resistors, semiconductors, ferrites etc. This is all part of our continuous training about the products that we sell.

The afternoon continues as the morning, with the second post bringing in more work. Queries are answered and quotations are followed up. There are occasions when goods will be returned because of technical problems. The customer must be reassured that the problem won't happen again.

Our sales engineers are among the callers during the day. They are visiting customers and will ring up with urgent problems and to find out if we have any messages for them.

Five o'clock arrives. The 'phones stop ringing and the office begins to empty. I often stay for an hour or so to clear up the paperwork after a busy day on the 'phones.

Sarah Godsal at work. Sarah has both O- and A-level physics. After one year as a technical assistant with another company, she moved to her present post.

A Day in the Life of...

23

A SATELLITE DESIGN ENGINEER

I arrive at my office at 8.40 am at the same time as one of the secretaries. She's cross as she doesn't like the arrangements which have been made for her junior to be trained on the wordprocessor. A couple of minutes' discussion convinces me that I don't need to intervene; the training will get done quite well.

I'm looking forward to the most urgent task of the day — reviewing a technical report which one of my team has written on ground-station-to-satellite radio-frequency links. After half-an-hour I decide that there are probably a couple of errors in the work, but that the conclusions are correct. A brief discussion with the author proves fruitful; he'll check up on the method he has used and then I can authorise the document for circulation. It's a very useful piece of work and I feel we've both learned something from the review. Steve takes the opportunity of the review meeting to ask for advice on the testing and check-out of a spacecraft when first in orbit. The schedule for our project is very tight and we will have to complete the tests in less than one month, rather than the three-month period we are used to. I am thinking about the possibility of starting tests before the satellite has reached its correct position in orbit. If we do that there is a risk of our ground transmissions interfering with other satellites. I make a note that the team needs to assess whether this is a problem.

The final technical report on a study of a new satellite design, which I have been working on, should be ready for despatch today. It will be sent to the customer for circulation throughout the European space industry. It's the last thing to be completed on a study that has taken nearly 18 months and, while it's satisfying to see the work complete, I'm a little sorry too — I always enjoy working on the 'ideas for the next century'. I make the final arrangements to get the documents sent out and decide to walk through the main factory on the way back to my office. It's always useful to talk to people working on different projects; today I bump into one of the Public Relations staff. I want to know the latest information on a launch vehicle failure. She doesn't seem to know anything that hasn't already been in the journals — never mind, at least I'm as up-to-date as anyone is — the PR people always have their ears to the ground.

Dr Karen Burt with her team. Karen has both an MA and a PhD in physics.

Once I'm back in the office I hope to get an hour to do some work on the specification that I'm writing. I'm making good progress and hope that I may have the first draft complete by the end of the week.

After lunch I have to attend the weekly project meeting. Our project manager makes this meeting compulsory for the twenty or so senior members of the team. There are always a few grumbles about attending, but personally I feel that it is a useful forum for discovering what has been going on in all the other areas. It's worth an hour or so a week.

Today there are no particular points for discussion, but a recap of last week's main meeting and a brief mention of two meetings which will be held later this week. I shall need to attend one of these meetings and so make a note to re-read the relevant file before Thursday. I then make a report on the testing problem and ask for the launch schedules to be reviewed. As I anticipated, no-one is very optimistic about being able to shorten other work to find the extra two months I want, so I will get the review of the one-month test programme under way.

The meeting has taken just over an hour — about average; now I can get back to work on my specification before a meeting with my Head of Department.

Two telephone messages when I get back: one to tell me that the report has left the despatch department by courier — that's good — and the other to postpone the meeting — not so good — but at least it allows me a couple of hours of uninterrupted work before I go home.

A Day in the Life of...

24

A SCHOOL PHYSICS TECHNICIAN

My first priority is to make sure that all the equipment needed for the first lessons is out. Today it is the upper-sixth practical. Usually that means getting out an enormous number of heavy pieces of apparatus. One requirement of a physics technician is to have the muscles of a weightlifter! While new equipment is neat and small, school labs are full of ancient, awkward metal objects which have no inclination to come out of, or go into, cupboards. However, this time the upper sixth are doing a practice A-level question, so I rush around putting out bits and pieces as if for an exam. This particular question needs cells, potentiometer wires, galvanometers, voltmeters, varying lengths of wires, resistors, leads and crocodile clips, all for 13 people. Have I remembered everything? I make a mental note to check over the cells before next week.

I meet a biology teacher on the stairs; she is looking for her kidneys to dissect. Fortunately I had remembered to bring them in this morning (today is the biology technician's day off, as we all work part-time). This also reminds me to cut some grass for the locusts before it starts raining again. My memory is not very good, so I write down all instructions, or get the teachers to do so. They are supposed to give at least 24 hours notice of anything they need, but often they think of extra things at the last minute.

After break is a rare occasion in the week when one of the physics labs should be free, so it is a good opportunity to do any tidying up, cleaning out of cupboards etc. Today, however, I find one of the chemistry lessons has been moved there as there is an exam under way so, instead of tidying up, I catch up with the accounts and continue making a list of items to order. It is one of my jobs to make sure that we don't run out of bulbs, batteries, crocodile clips, leads, and all the other usual things that are taken for granted in physics labs. I will ask the Head of Physics about the more expensive items. We have a set allowance each year, so I have to make sure we don't overspend.

After half an hour's lunchbreak, there would normally be four first-year 'Integrated Science' lessons to get ready, but today the first-year pupils involved are all out on a trip, so I help with the washing up from the chemistry exam. Later there are three fourth-year lessons. One class is using trolleys and ticker timers, so I check that all these are working properly. One lesson is in a lab donwstairs, but only metre rules and weights are needed. The others must be doing surface tension judging by the bits and pieces the teacher has put out.

I tidy up all the sixth-form apparatus from this morning — most of it was left in a muddle on the side. One or two leads have their ends missing so I add them to a boxful in the prep room. A power pack has appeared there, presumably out of order. I can't see anything wrong when I open it up, so I simply change the fuse and it works. Why do they have the fuses inside, I wonder? There is a constant stream of repairs to do. However, my day finishes at 3.30 pm so I quickly check tomorrow's work. The apparatus from the fourth-year lessons will be cleared away tomorrow morning.

Margaret Walkley, school physics technician, at work. Although Margaret has a degree, school technicians would normally have either a City and Guilds qualification or a BTEC certificate or diploma. Some technicians enter the profession only with relevant O- or A-levels and are trained on the job.

A Day in the Life of...

25

A Scientific Journalist

Today is an "office" day, when I will be based at my desk rather than visiting a research establishment or going to a press conference. As usual, I arrive at the Publishing Division offices at about 10 o'clock — we operate a flexible system (we have to work 35 hours in a week) and I generally arrive late and work late. By the time I get to my desk, my secretaries will have opened our large pile of post from all over the world (it's a great place for stamp collectors!) and loaded it into various "in" trays, depending on which publication it's relevant to. The urgent or really unusual stuff will be sitting on my desk.

My colleague Alan and I are staff editors responsible for the content of seven physics publications. Three of these are magazines, dealing with general physics, physics education and physics in industry, and contain articles and news stories. The others are research journals which contain scientific papers about new results in the fields of medical physics and scientific instruments. Alan and I have three editorial assistants and three secretaries to help us deal with this vast amount of material but even so it's a hectic life in our big open-plan office.

The first thing I do is flip through our "Press File". This is a red folder into which we all put items of general interest which arrive in our post — usually press releases about new products or research discoveries, invitations to press conferences, copies of companies' annual reports, announcements of meetings etc. This is passed round the half-dozen or so people who write news stories. Today is quite a good day and I put my initials on notices about an Open Day at some government research labs, a meeting (plus lunch!) to launch a new Engineering Council report, and four press releases about interesting bits of research which I may write up as news stories when the next deadline arrives.

Meanwhile, Kathleen, one of our editorial assistants, has been looking over the new medical physics papers submitted today and wants some advice. It's very important to people doing scientific research to get papers describing their experiments and results published in well known journals. When someone sends us a paper we have to find two people — anywhere in the world — who are experts on that subject and ask them for an opinion as to how good the paper is, whether it contains original work and whether the results are right. Before we can find two "referees" we have to read through the paper and give it some classification numbers which will help us locate a list of suitable people. This is a particularly tricky paper describing how to measure blood flow under the skin. It takes us ten minutes to sort out the right numbers and find a referee in Japan and another one in Nigeria whom we will ask to comment.

Our cheerful tea lady deposits a much needed cup of coffee on my desk and I decide to tackle next the pile of reports which have come in from referees who were sent papers some weeks ago. In most cases I write to the author asking him or her to rewrite their paper to answer questions and criticisms made by the referees. In two cases — hooray! — I am able to accept the paper for publication. I can now pass these downstairs to my colleagues in the production department who will edit the papers into good, clear, grammatical English (for many of our authors, English is not their usual language) and send them off to the printers. The next time I see these papers they will be in print!

Half an hour to spare before lunch, so I turn my attention to a pile of physics books which I want to have reviewed in our publications. With a bit of head scratching I come up with people to send them to and pass names and addresses on to our book review secretary.

After lunch is a good time to make a few 'phone calls chasing authors who are supposed to be writing magazine articles for me but who haven't delivered yet. Professors are the worst culprits!

The afternoon flies past and my attempts to turn the scrawled notes I took at a press conference last week into a lively, interesting and knowledgable-sounding news item are frequently interrupted by 'phone calls from referees and authors apologising for falling behind schedule or asking for news of their papers. There's also a call from the Netherlands. It's the project manager of the recent Giotto mission to Halley's comet. I am hoping to publish in one of the journals details of the scientific instruments on board Giotto. We discuss a few problems.

Two baskets full of post for me to sign today. My secretaries have once again performed the magic trick of turning my illegible scrawl into beautiful efficient-sounding letters!

After 4 o'clock things get a bit quieter as the busy clatter of typewriters and word processors lessens as most of the secretaries go home. For a couple of hours I get some good solid writing done. I also read carefully through an article I invited about how physics techniques can be used to work out the age of ancient Chinese pottery. I jot down a few comments.

Six o'clock and there's just time to flick through the eight physics magazines and journals from other publishers which have been building up on my desk. My mind buzzing with ideas for articles and news stories I could follow up, I head for home.

Sally Croft, scientific journalist. Sally has a degree in physics.

A Day in the Life of...

26

A SEMICONDUCTOR TECHNOLOGIST

Work for me begins at 8.30 am when I switch on the air conditioning, power and various other services to the "clean room" where we process slices of silicon into transistors. The room is temperature and humidity controlled, and contains banks of furnaces (for diffusing impurities into the silicon), extract cabinets (for acids and solvents) and an area for photolithography (a photographic way of opening a "window" on the silicon to allow the impurities in).

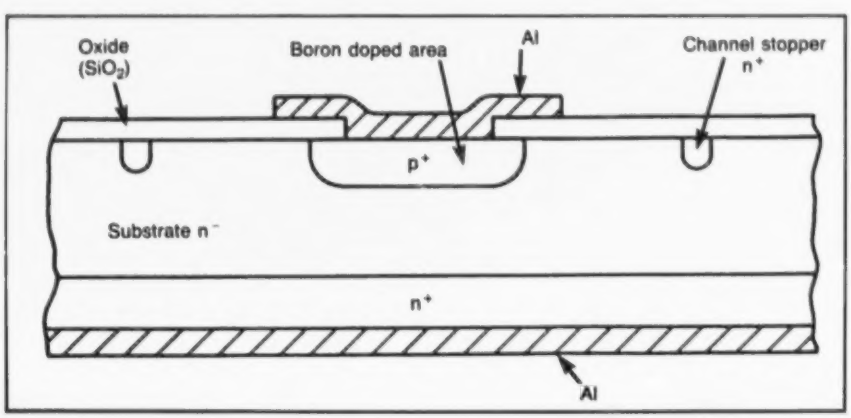
The work schedule for today depends partly on the previous day's work and partly on what I fancy doing. Each "batch" of slices takes about a week to process into transistors and we usually have several batches being processed at any one time. To decide the best order for processing today, I have a chat with Carole and Audrey to see what they are doing and we negotiate about which bits of equipment we each want to use.

My first task this morning is to unload some slices from furnace G, where the impurity boron has been diffusing overnight. I put on my special "clean room" overalls and overshoes and tuck my hair up into my hat before going into the "clean room". Using a long pull-rod, I hook the boat containing my slices out of the long furnace tube and leave it for a few minutes to cool down. The next step is to prepare the slices for the phosphorus impurity to be introduced. The photolithographic process used to do this is lengthy and complicated and takes me the rest of the morning (with a coffee break at a convenient stage of the process).

Lunchtime is spent out on the sports field as it is such a lovely day. After lunch, Carole takes the slices I prepared this morning to another department where the phosphorus impurity will be introduced. In the meantime, I have to finish off another batch of slices by depositing metal contacts onto them. I load the slices into the evaporator and place the metal (nickel) into its container, ready for evaporation. I can then leave it for an hour to pump down to a good vacuum. This gives me a chance to write up my logbook with the work I've done in the past few days.

Nikki Swetman left school with eight O-levels, including physics and maths, to take up a two-year scholarship for girl technicians with the Engineering Industry Training Board. This broadly based electronics training included day release to college for a TEC (now BTEC) Certificate. Nikki later obtained a Higher Certificate in Electronics.

My group leader drops in for a chat to see what I'm doing and is very enthusiastic about a new process we're trying. This is an attempt to improve the performance of some Schottky diodes — these are diodes which turn on very quickly. I finally manage to get away and evaporate the nickel onto my slices, but, as there isn't time to finish the contacts, I will leave them in the evaporator until tomorrow. To occupy my time for the last part of the day I settle down to try to understand a report that I was supposed to read. This is not always easy as reports are often badly written and full of complicated mathematics. Before I know it, the pips go at 4.30 pm and I rush around turning everything off in the "clean room" before going home.



Cross section of a silicon diode showing the boron-doped area.

A Day in the Life of... 27

A Senior Civil Servant

If it's to be a normal day in the office, the alarm goes off at 07.36 – a more comfortable time than 07.30 or 07.45. If I don't get up immediately, I probably never will, so I go downstairs and listen to the *Today* programme as I have breakfast. Sometimes I hear one of the Department's Ministers talking about the area I am responsible for – perhaps the Secretary of State on skill shortages in key areas like information technology, or John Butcher about the importance of good design and quality for British industry. Some of my staff will probably have been responsible for providing information for him so it's nice to hear the results of their efforts.

As head of the Quality, Design and Education Division in the Department of Trade & Industry, my days are very varied. I am responsible for managing 80 staff and an annual budget of some £56m. About half of the staff are involved in activities aimed at encouraging links between industry and education: perhaps encouraging young people to consider careers in industry, or getting computers and software into schools, or producing *View* our magazine for schools. The other half are working on programmes to promote design, quality and standards – showing the world that the best British companies are at least as good as the Japanese and helping those that aren't yet to catch up. The £56m is taxpayers' money so we have to make sure it is well spent.

After a quick run through the diary with Karen, my secretary, I turn to the pile of paper in my "in" tray. At least 40 items come in every day but fortunately most are copies of things my staff are dealing with – speeches for Ministers, answers to Parliamentary Questions, briefings for meetings etc. My role now is to organise others and the 20 years spent working my way up through the department certainly help. It's a long time since I used my physics degree directly, but I certainly find it a help working in a department with a high proportion of scientists and engineers. Even in representing the UK in negotiations on Codes of Conduct on multinational companies in the United Nations, for example, it proved a good general training, as I'm sure those of my colleagues, who joined the department's Research Establishments as physicists and then came to headquarters later in life, would agree.

Sometimes as I go through the papers I add a comment or give advice on how to deal with an item. After setting aside longer reports and papers for reading in depth later, I turn to those that need action. Some are drafts of letters for me to sign and I add a few personal touches before giving them to Karen to type. Others need more input and I may need to talk to the author. The ones I like best, of course, are those that I can send back with the comment 'this is fine – thanks very much'. It gives me tremendous satisfaction to see my staff doing well – for example the young woman who recently organised a very successful exhibition of projects from Industry Year.

The day will involve meetings, large and small. I might take a team to see the Minister about the next phase of the National Quality Campaign. Can he spend one day next month in the South West, visit several companies, give a Press Conference and launch a programme to help small companies in the area to improve their quality? Then it's back to my office to chair a difficult meeting with representatives of an organisation to which we have given a grant for a project which hasn't gone to plan. Shall we give them an extra grant to enable the project to go on or is it clear that it cannot succeed? This time we agree on an extra grant, but unfortunately it isn't always possible.

About twice a week I have official lunches – sometimes large formal events with speeches, more often smaller, informal groups.

After lunch, more discussions and meetings. Perhaps one of our regular sessions with the staff at the Engineering Council to talk about a whole variety of subjects, from the 'Young Engineer' competition, to career breaks for women. This latter is very dear to my heart – how to help young women who have started on a career in industry to keep up to date while taking a break to have a family and return to pick up their careers when the children reach school age. It's sound commercial sense for both the company and the young woman to protect their investment in her skills.

Dr Pamela Denham has been an Under Secretary at the Department of Trade & Industry since 1985.

Then back to the office to clear more papers and to talk to a colleague about how best to fill a vacancy left by a recently promoted member of staff.

Karen puts her head around the door to say goodnight at about 17.15, leaving me an hour's peace to tie up loose ends before collecting my papers to take home for tomorrow. Sometimes I may have to go to a dinner, but most evenings it's home, via the supermarket, to unwind over cooking dinner. It's a good way to relax before putting my feet up to watch the television. Tomorrow it's an early start for one of my regular trips to a Regional Office to bring the staff up to date with our activities. This time it's Newcastle upon Tyne, a special pleasure, as it's my home city. A full programme has been organised including lunch at Durham University with the Vice-Chancellors and the Principals of the five North Eastern Universities and Polytechnics, visits to two successful companies in Hartlepool, a dinner with industrialists in Durham (at which I have to make a speech) followed, the next day, by more visits.

I admit there's a lot of paper but the job really is about working with people, whether it's organising my staff to get the job done and at the same time developing their talents to the full, or liaising with people outside the Department, all with one main objective – helping British companies to succeed and to show the world they can.

A Day in the Life of...

28

A TELEVISION BROADCAST ENGINEER

I turn up at 8.25 am. I'm not first in; a colleague has already switched on power to all the machines. I go to the office to look at today's booking sheet. A glance at the sheet tells me which jobs I'm likely to be doing. There are two edit suites, both running till 10 o'clock tonight: a situation comedy in Studio 1, which will be a live-audience show; a kid's show in Studio 3; some routine dubbing and an audio booking. It doesn't look like there'll be much time for routine maintenance today, and I guess I'll be doing the audio booking.

I am allocated a control room and a VTR machine for the morning. We operate all machines remotely here, not at the machine's side, so a control room tends to be my base for the day. I go into Control Room 4 and check that all the equipment seems to be working. The job I'll be doing is replacing the soundtrack on a tape just prior to transmission. This is the last job in the chain of production work. The programme has been edited and is complete as far as the vision is concerned. The sound is "layed off" (i.e. transferred) onto a multitrack audio machine and any necessary audio treatment is dubbed on. This might mean the addition of door bangs, 'phone rings, traffic noise, birdsong etc, or the addition of a voice-over or music, or the equalisation of a particular section, if a problem had crept in during shooting. After the dub, all the various audio alterations are mixed down onto a single track, which is then transferred back onto the original videotape (known as "laying back"). While dubbing, they work from a U-matic cassette of the vision so that they can relate the sound to the vision.

I see from the sheet that today there are a number of "lay backs" and one "lay off". I go to find the person in the sound department whom I'll be working with that morning, and we agree the order in which we'll do things. Having checked that all the necessary tapes are present, I go over to the canteen for a coffee with a couple of colleagues. I'm back by 9.00 am and lining up the machine for the first job of the day.

Each time a tape goes onto any machine, the tape path is cleaned to be free of oxide dust, and the playback characteristics are checked and adjusted to get the best possible signal from that particular tape. We are doing the lay off first, so it's only the sound that is really important, but I check the vision as well because my colleague in the sound department next door will be making a U-matic cassette for use in the dub.

I liaise with him over talkback (there is key-operated talkback to, and from, most areas) and we get under way. It's only a 30-minute programme, and I check technical quality as it goes through and he records the sound. I then set the machine up for the lay back, which means going into audio-only record. (Obviously it's very important not to go into video record, or I'd wipe the programme.) Dave, on the other end, is ready now, and I settle back to watch the programme go through. The next time this tape comes out of its box will be for transmission, so this is the last chance to pick up any faults or flaws in it. Fortunately all goes well. While the tape is running through, I make two VHS copies of it: one to go to the VHS library and one to go to Oracle, so that they can prepare subtitles for the programme prior to transmission.

Three programmes later, it's lunchtime. After lunch I come back and run some copies of tapes to go to Channel 4. I take a second machine for this, so one is recording and one playing back. I can operate them both remotely from the control room. There is a big "drop-out" on one of them, where some oxide has been shed from the tape. Fortunately, it occurs on a still photographic section of the programme, with enough at the front of the shot to pinch a bit from, so I go back and edit over the flaw on the copy I'm making.

It's the end of another day. I pack up everything at about 6.45 pm and make sure that the area is clean and tidy for tomorrow.

Jo Goldenberg, shown here using a VTR machine in one of the edit suites of the television studio. Jo has a BSc in physics.